

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

EXPRESS MAIL LABEL NO.: EL 697 493 333 US

JC03 Rec'd PCT/TO

17 SEP 2001

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US)

CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: Yanagihara Case 62

U.S. APPLICATION NO.

(If known, see 37 CFR 1.5): Unknown

INTERNATIONAL APPLICATION NO.: PCT/JP00/02044 INTERNATIONAL FILING DATE: March 30, 2000

PRIORITY DATE CLAIMED: March 31, 1999

TITLE OF INVENTION: COSMETIC PRODUCT CONTAINING POLYSACCHARIDE-STEROL DERIVATIVE

APPLICANTS FOR DO/EO/US: (1) Junzo SUNAMOTO, (2) Kunio SHIMADA, (3) Akio HAYASHI, (4) Ryuzo HOSOTANI,

(5) Yoshihiro YANO and (6) Kazunari AKIYOSHI

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19<sup>th</sup> month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
  - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☒ has been transmitted by the International Bureau.
  - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)).
  - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☐ have been transmitted by the International Bureau.
  - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
  - d. ☐ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

**Items 11. to 16. below concern document(s) or information included:**

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment.  
☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information:
  - Title Page of WIPO Document WO 00/57841
  - Form PCT/IB/301 – Notification of Receipt of Record Copy
  - Form PCT/IB/304 – Notification Concerning Submission or Transmittal of Priority Document
  - Form PCT/IB/308 – Notice Informing Applicant of Communication of International Application to Designated Offices
  - Form PCT/IPEA/409 – English Language International Preliminary Examination Report
  - English Language International Search Report including References cited therein
  - Postal Card

FORM PTO-1390

U.S. APPLICATION NO.

(if know, see 37 CFR 1.5):

Unknown

INTERNATIONAL APPLICATION NO.:

PCT/JP00/02044

ATTORNEY'S DOCKET NUMBER:

Yanagihara Case 62

17. [X] The following fees are submitted:

CALCULATIONS PTO USE ONLY

**BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5)):**

Neither international preliminary examination fee (37 CFR 1.482)  
nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO  
and International Search Report not prepared by the EPO or JPO .... \$1000.00

International preliminary examination fee (37CFR 1.482) not  
paid to USPTO but International Search Report prepared by  
the EPO or JPO ..... \$ 860.00

International preliminary examination fee (37 CFR 1.482) not  
paid to USPTO but international search fee (37 CFR 1.445(a)(2))  
paid to USPTO ..... \$ 710.00

International preliminary examination fee paid to USPTO (37  
CFR 1.482) but all claims did not satisfy provisions of PCT  
Article 33(1)-(4) ..... \$ 670.00

International preliminary examination fee paid to USPTO (37 CFR  
1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) ... \$ 100.00

**ENTER APPROPRIATE BASIC FEE AMOUNT = \$860.00**

Surcharge of \$130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30  
months from the earliest claimed priority date (37 CFR 1.492(e)). \$

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total claims	9 - 20 =	0	X \$ 18.00	\$
Ind. claims	1 - 3 =	0	X \$ 80.00	\$
MULTIPLE DEPENDENT CLAIMS (if applicable)			+ \$270.00	\$
<b>TOTAL OF ABOVE CALCULATIONS</b>			<b>=</b>	<b>\$860.00</b>

Reduction of 1/2 for filing by small entity, if applicable. Small Entity Statement  
must also be filed (Note 37 CFR 1.9, 1.27, 1.28).

**SUBTOTAL = \$860.00**

Processing fee of \$130.00 for furnishing the English translation later than ☐ 20 ☐ 30  
months from the earliest claimed priority date (37 CFR 1.492(f)). + \$

**TOTAL NATIONAL FEE = \$860.00**

Fee for recording assignment (37 CFR 1.21(h)). The assignment must be accompanied  
by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property + \$ 40.00

**TOTAL FEES ENCLOSED = \$900.00**

**Amount to be refunded \$**  
**charged \$**

- a. [X] A check in the amount of \$900.00 to cover the above fees is enclosed.  
b. ☐ Please charge my Deposit Account No. \_\_\_\_\_ in the amount of \$ \_\_\_\_\_ to cover the above fees. A duplicate  
copy of this sheet is enclosed.  
c. [X] The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to  
Deposit Account No. 06-1382. A duplicate copy of this sheet is enclosed.

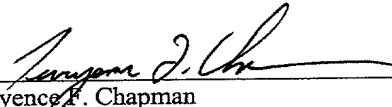
**NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a)  
or (b)) must be filed and granted to restore the application to pending status.**

IN DUPLICATE

SEND ALL CORRESPONDENCE TO:  
FLYNN, THIEL, BOUTELL & TANIS, P.C.  
2026 Rambling Road  
Kalamazoo, Michigan 49008-1699

300.0900

Form PTO-1390 Page 2 of 2

  
Terryence F. Chapman  
Registration Number: 32 549

Express Mail Label No.: EL 697 493 333 US

09/936953

JCOS Rec'd PCT/PTO

17 SEP 2001

IN THE U.S. PATENT AND TRADEMARK OFFICE

September 17, 2001

Applicants: Junzo SUNAMOTO et al  
 For : COSMETIC PRODUCT CONTAINING  
 POLYSACCHARIDE-STEROL DERIVATIVE

PCT International Application No.: PCT/JP00/02044

PCT International Filing Date: March 30, 2000

U.S. Application No.

(if known, see 37 CFR 1.5): Unknown

Atty. Docket No.: Yanagihara Case 62

Box PCT

Assistant Commissioner for Patents

Washington, DC 20231

**PRELIMINARY AMENDMENT CANCELING CLAIMS**

Sir:

Prior to calculation of the filing fee in the above-identified application, kindly enter the following:

**IN THE CLAIMS**


Please amend Claims 3-9 as shown on the enclosed marked-up pages. Pursuant to 37 CFR 1.121, replacement pages with the amended claims presented in clean form are also enclosed.

**REMARKS**

This amendment cancels claims to reduce the filing fee. Please enter this amendment before calculating the filing fee.

Respectfully submitted,

TFC/smd

  
 Terryence F. Chapman

FLYNN, THIEL, BOUTELL  
 & TANIS, P.C.  
 2026 Rambling Road  
 Kalamazoo, MI 49008-1699  
 Phone: (616) 381-1156  
 Fax: (616) 381-5465

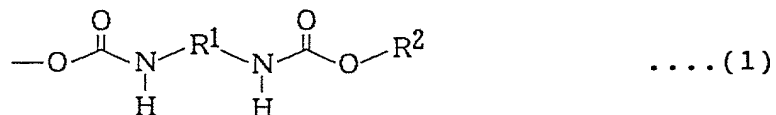
Dale H. Thiel  
 David G. Boutell  
 Ronald J. Tanis  
 Terryence F. Chapman  
 Mark L. Maki  
 David S. Goldenberg  
 Sidney B. Williams, Jr.  
 Liane L. Churney  
 Brian R. Tumm  
 Tricia R. Cobb

Reg. No. 24 323  
 Reg. No. 25 072  
 Reg. No. 22 724  
 Reg. No. 32 549  
 Reg. No. 36 589  
 Reg. No. 31 257  
 Reg. No. 24 949  
 Reg. No. 40 694  
 Reg. No. 36 328  
 Reg. No. 44 621

Encl: Marked-Up and Clean Amended Claims 3-9

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3. (Amended) The cosmetic product as claimed in claim ~~1-or-2~~, wherein the hydroxyl groups of the monosaccharide units constituting the polysaccharide of the polysaccharide-sterol derivative are substituted, in a proportion of 0.01 to 20 groups per 100 monosaccharide units, by the radical represented by the formula (1)



in which R<sup>1</sup> denotes a hydrocarbyl of 1-10 carbon atoms and R<sup>2</sup> represents a steryl group.

4. (Amended) The cosmetic product as claimed in claim ~~2-or-3~~, wherein the proportion of introduction of the steryl groups is 0.05-15 groups per 100 monosaccharide units constituting the polysaccharide.

5. (Amended) The cosmetic product as claimed in claim ~~2-or-3~~, wherein the proportion of introduction of the steryl groups is 0.1-10 groups per 100 monosaccharide units constituting the polysaccharide.

6. (Amended) The cosmetic product as claimed in ~~any one of claims 1 to 5~~claim 1, wherein the polysaccharide-sterol derivative is a pullulan-cholesterol derivative.

7. (Amended) The cosmetic product as claimed in ~~any one of claims 1 to 6~~claim 1, wherein the content of the polysaccharide-sterol derivative is in the range from

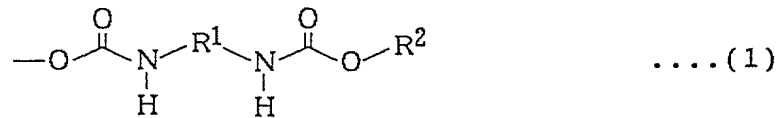
0.001 to 50%, based on the total weight of the cosmetic product.

8. (Amended) The cosmetic product as claimed in ~~any one of claims 1 to 7~~claim 1, wherein the cosmetic product is a skin care cosmetic, make-up cosmetic or hair conditioning cosmetic.

9. (Amended) The cosmetic product as claimed in ~~any one of claims 1 to 7~~claim 1, wherein the cosmetic product is an emulsion, a beauty wash, a rouge, a manicure or a hair lotion.

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3. (Amended) The cosmetic product as claimed in claim 1, wherein the hydroxyl groups of the monosaccharide units constituting the polysaccharide of the polysaccharide-sterol derivative are substituted, in a proportion of 0.01 to 20 groups per 100 monosaccharide units, by the radical represented by the formula (1)



in which R<sup>1</sup> denotes a hydrocarbyl of 1-10 carbon atoms and R<sup>2</sup> represents a steryl group.

4. (Amended) The cosmetic product as claimed in claim 2, wherein the proportion of introduction of the steryl groups is 0.05-15 groups per 100 monosaccharide units constituting the polysaccharide.

5. (Amended) The cosmetic product as claimed in claim 2, wherein the proportion of introduction of the steryl groups is 0.1-10 groups per 100 monosaccharide units constituting the polysaccharide.

6. (Amended) The cosmetic product as claimed in claim 1, wherein the polysaccharide-sterol derivative is a pullulan-cholesterol derivative.

7. (Amended) The cosmetic product as claimed in claim 1, wherein the content of the polysaccharide-sterol derivative is in the range from 0.001 to 50%, based on the total weight of the cosmetic product.

8. (Amended) The cosmetic product as claimed in claim 1, wherein the cosmetic product is a skin care cosmetic, make-up cosmetic or hair conditioning cosmetic.

9. (Amended) The cosmetic product as claimed in claim 1, wherein the cosmetic product is an emulsion, a beauty wash, a rouge, a manicure or a hair lotion.

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10/16/00 09:09:00

SPECIFICATION

09/936953  
JC03 Rec'd PCT/70 17 SEP 2001

COSMETIC PRODUCT CONTAINING POLYSACCHARIDE-  
STEROL DERIVATIVE

## FIELD OF THE INVENTION

The present invention relates to a cosmetic product containing a polysaccharide-sterol derivative. More specifically, the invention relates to a cosmetic product containing a polysaccharide-sterol derivative, which has a superior feature that it is superior in a moisture-retaining effect on skin and in a effect of improving skin roughness, on the one hand, and is superior in the protection effect on hair by a film-forming function, on the other hand, with superior product stability.

## BACKGROUND OF THE INVENTION

In general, drying of skin occurs when the barriering function of keratin becomes decreased and the transcutaneous moisture transpiration becomes increased due to reduction of amount of skin secretory substances, in particular, sebum secretion, as well as due to decrease in the natural moisture-retaining factors, such as intercellular lipids and amino acids. Therefore, drying of skin occurs increasingly by decrease in skin secretory substances in winter season or due to, for example, excessive skin washing, aging and physical



constitution, wherein, in particular, a state in which the keratin moisture decreases below 10 % by weight is called dry skin. When skin becomes dry, the appearance of skin will be dull and fine wrinkles become undesirably conspicuous. Also hair becomes losing its smoothness and decreasing its luster undesirably due to decrease in its moisture content.

In order to improve such conditions of skin and of hair, it is necessary to prevent reduction of moisture content in keratin and in hair to maintain normal function of them, wherefor moisture retaining agents have hitherto been examined. As a result, it has been confirmed that it is effective for increasing moisture retention to incorporate a polyhydric alcohol exhibiting better adhesion onto skin and having a hydrophobic function, such as vaseline or glycerin; a polysaccharide, such as hyaluronic acid, sorbitol or pullulan; sodium lactate; or an amino acid, such as sodium pyrrolidonecarboxylate. Recently, it has been practised also to incorporate a sphingolipid and ceramide which are constituents of the intercellular lipids in keratin.

However, such preparations known hitherto are not able to say as sufficient in the moisture retaining ability and, in addition, they reveal a defect that unpleasant touch feel due to oily consistency may be brought about when a blocking agent is incorporated, whereby an adherent touch is caused, and, on the other hand, the moisture retaining agent has to be incorporated at a higher proportion, giving birth to an

[illegible]

(1) Japanese Patent Kokai Sho 53-142540 A discloses a cosmetic oil-soluble finishing product providing for superior hand feel without bringing about irritation onto skin, which contains a fatty acid pullulan ester.

(3) Japanese Patent Kokai Sho 63-139105 A discloses a wrinkle-smoothing cosmetic product characterized by blending pullulan.

(5) Japanese Patent Kokai Hei 10-182341 A discloses a cosmetic pack containing a fatty acid pullulan ester.

While, in addition, polysaccharide-sterol derivatives have been disclosed in Japanese Patent Kokais Hei 3-292301 A, Hei 5-262645 A and Sho 63-319046 A, it has absolutely not been known to use them in

cosmetic product.

The object of the present invention is to provide cosmetic product which is superior in the moisture retaining ability and in the film-forming ability to attain thereby improvement of the condition of skin or hair caused by drying, such as rough skin and defective luster, and to provide a wet state of so-called beautiful skin or beautiful hair by retaining sufficient moisture, together with superior touch feel.

#### DISCLOSURE OF THE INVENTION

The inventors had, in respect of the problems given above, conducted sound researches, whereby they found that it is able to obtain a cosmetic product having such effects that moisture retaining ability is high due to hygroscopic and moisture-retaining function, that functions for facilitating lamella formation and for stabilization are superior and that the ability for film-forming is superior and an oily feel on skin is suppressed low, when a polysaccharide-sterol derivative obtained by reacting a polysaccharide which is superior in film-forming ability with a sterol which is found in the intercellular lipids is incorporated in the cosmetic product. Thus, the inventors found that such a polysaccharide-sterol derivative can solve as an ideal additive all the problems involved in conventional cosmetic products, whereby the present invention has been completed.

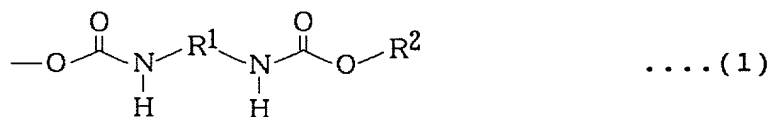
Thus, the present invention consists in the

following cosmetic product containing a polysaccharide-sterol derivative:

(1) A cosmetic product containing polysaccharide-sterol derivative, comprising cosmetic components and a polysaccharide-sterol derivative.

(2) The cosmetic product as defined in the above (1), wherein the polysaccharide-sterol derivative is one in which steryl groups are introduced in a proportion of 0.01 to 20 groups per 100 monosaccharide units constituting the polysaccharide.

(3) The cosmetic product as defined in the above (1) or (2), wherein the hydroxyl groups of the monosaccharide units constituting the polysaccharide of the polysaccharide-sterol derivative are substituted, in a proportion of 0.01 to 20 groups per 100 monosaccharide units, by the radical represented by the formula (1)



in which R<sup>1</sup> denotes a hydrocarbyl of 1 - 10 carbon atoms and R<sup>2</sup> represents a steryl group.

(4) The cosmetic product as defined in the above (2) or (3), wherein the proportion of introduction of the steryl groups is 0.05 - 15 groups per 100 monosaccharide units constituting the polysaccharide.

(5) The cosmetic product as defined in the above (2) or (3), wherein the proportion of introduction of the steryl groups is 0.1 - 10 groups per 100 monosaccharide units constituting the polysaccharide.

(6) The cosmetic product as defined in any one of the above (1) to (5), wherein the polysaccharide-sterol derivative is a pullulan-cholesterol derivative.

(7) The cosmetic product as defined in any one of the above (1) to (6), wherein the content of the polysaccharide-sterol derivative is in the range from 0.001 to 50 %, based on the total weight of the cosmetic product.

(8) The cosmetic product as defined in any one of the above (1) to (7), wherein the cosmetic product is a skin-care cosmetic, make-up cosmetic or hair conditioning cosmetic.

(9) The cosmetic product as defined in any one of the above (1) to (7), wherein the cosmetic product is an emulsion, a beauty wash, a rouge, a manicure or a hair lotion.

#### THE BEST MODE FOR EMBODYING THE INVENTION

The polysaccharide-sterol derivative to be used according to the present invention is one in which a sterol group is introduced into a polysaccharide through an adequate chemical bond, wherein any one can be included, so long as it is classified in general as a polysaccharide-sterol derivative. For the polysaccharide, any high-polymeric compound in which glucose is subjected to polyglycosylation can be used without any restriction. Concrete examples of the polysaccharide include pullulan, amylose, xyloglucan, amylopectin, dextran, dextrin, cyclodextrin, mannan,

hydroxyethyl-dextran, levan, inulin, chitin, chitosan and water-soluble cellulose. Such polysaccharides may be of either natural or synthetic origin.

For the sterol, any alcohol having a cyclopentanoperhydrophenanthrene skeleton, cholesterol skeleton or a skeleton of derivatives of these or a molecular structure having intimate correlation with these skeletons can be used without any restriction. Concrete examples of sterol include cholesterol, stigmasterol,  $\beta$ -cytosterol, lanosterol and ergosterol. For the polysaccharide-sterol derivatives, for example, those which are disclosed in Japanese Patent Kokais Hei 2-144140 A, Sho 63-319046 A and Hei 3-292301 A may favorably be employed.

For the polysaccharide-sterol derivatives to be incorporated in the cosmetic product according to the present invention containing polysaccharide-sterol derivative (referred to hereinafter sometimes simply as the "cosmetic"), there may be used those which are produced by a synthetic process contrived pertinently based on present knowledges of chemistry, while it is favorable to use ones which are produced by the process disclosed in Japanese Patent Kokai Hei 3-292301 A. Polysaccharide-sterol derivatives which are more favorable in view of easiness of synthesis are those in which the hydroxyl groups of the monosaccharide units constituting the polysaccharide of the polysaccharide-sterol derivative are substituted, in a proportion of 0.01 to 20 groups, preferably 0.05 to 15 groups, more preferably 0.1 to 10 groups, per 100

monosaccharide units, by the radical represented by the formula (1) given above.

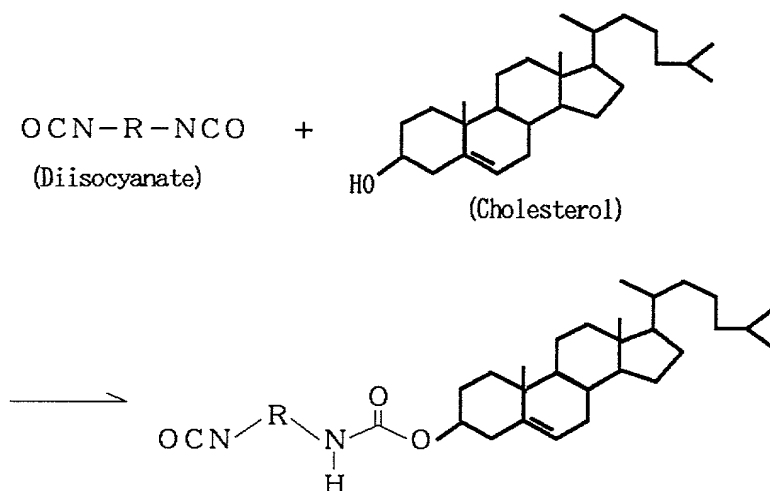
In the formula (1),  $R^1$  represents a hydrocarbyl of 1 - 10 carbon atoms, which may be a linear, branched linear or cyclic one and be either saturated or unsaturated one, so long as it deals with a divalent hydrocarbyl, wherein a linear saturated hydrocarbyl of 3 - 8 carbon atoms is most preferable.

In the formula (1),  $R^2$  stands for a steryl group (i.e. residue of the sterol) and may be recited therefor, for example, cholesteryl (residue of cholesterol), stigmasteryl (residue of stigmasterol),  $\beta$ -cytosteryl (residue of  $\beta$ -cytosterol), lanosteryl (residue of lanosterol) and ergosteryl (residue of ergosterol). Among them, cholesteryl (residue of cholesterol) is at the most preferred in view of easy availability.

The polysaccharide-sterol derivative can be synthesized by reacting a compound having at one terminal end of the molecule a steryl group and at the other terminal end of the molecule an isocyanato group with a hydroxyl group on the polysaccharide.

The compound having at one terminal end of the molecule a steryl group and at the other terminal end of the molecule an isocyanato group is obtained, for example, by reacting one isocyanato group at one end of a diisocyanate with a hydroxyl group on a sterol to bind them via an urethane bond, as shown by the following reaction scheme (2):

Reaction scheme (2)



As the sterol to be used here for reacting with the diisocyanate, for example, cholesterol, stgmasterol,  $\beta$ -cytosterol, lanosterol or ergosterol may be chosen, wherein cholesterol is preferred in the point of view of easy availability.

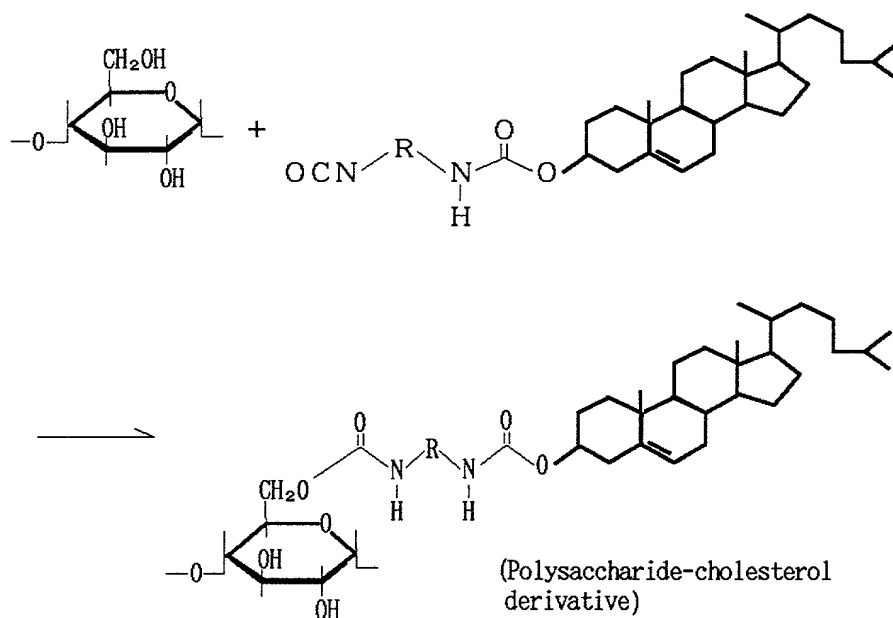
The diisocyanate to be reacted with the sterol is a compound represented by  $\text{O C N} - \text{R} - \text{N C O}$ . There may be enumerated, for example, ethylene diisocyanate in which the group R stands for ethylene, butylene diisocyanate in which R stands for butylene, hexamethylene diisocyanate in which R stands for hexamethylene and diphenylmethane diisocyanate in which R stands for diphenylmethane, wherein preference is given to butylene diisocyanate and hexamethylene diisocyanate.

The polysaccharide-sterol derivatives to be used favorably according to the present invention can be obtained by reacting a compound having a steryl



group at one terminal end of the molecule and an isocyanato group at the other terminal end with a polysaccharide. The reaction of the compound having a steryl group and an isocyanato group at one terminal end and at the other terminal end of the molecule, respectively, with the polysaccharide may be realized in a one-step addition reaction of a hydroxyl group on the monosaccharide constituting the polysaccharide with the isocyanato group of the compound having a steryl group and an isocyanato group at one terminal end and at the other terminal end of the molecule, respectively, as shown, for example, by the following reaction scheme (3):

Reaction scheme (3)



While the reaction scheme (3) shows a reaction of a hexose unit with an isocyanato-containing compound as a reaction model, it is favorable in the synthesis

of a polysaccharide-sterol derivative according to the present invention to cause the reaction as indicated by the reaction scheme (3) for the hydroxyl groups on the monosaccharide units constituting the polysaccharide in a proportion of 0.01 to 20 groups, preferably 0.05 to 15 groups, more preferably 0.1 to 10 groups, per 100 monosaccharide units, in view of increasing the realistic application feel as a cosmetic.

As the polysaccharide to be used for the above reaction, any one can be used so long as it is a polysaccharide, while it is preferable to use a polysaccharide selected among pullulan, amylose, xyloglucan, amylopectin, dextran, dextrin, cyclodextrin, mannan, hydroxyethyl dextran, levan, inulin, chitin, chityosan and water-soluble cellulose and so on. Such polysaccharides may be either those of natural occurrence or of synthetic ones, wherein they may be any ones even though their molecular weights and so on are whatever values, while they may favorably have a weight-average molecular weight in the range of 10,000 - 1,000,000 or so, preferably in the range of 30,000 - 500,000, in order to cause on blending into a cosmetic product to reveal their characteristic features more effectively. Concerning the kind of the polysaccharide, pullulan may particularly favorably be used, in view of easy availability and of better touch feel when incorporated in cosmetic products.

As the solvent to be used on the reaction of the compound having a steryl group at one terminal end and an isocyanato group at the other terminal end of

the molecule with the polysaccharide, there may favorably be used those in which both the compound having a steryl group at one terminal end and an isocyanato group at the other terminal end of the molecule and the polysaccharide are soluble and the reaction product, i.e. the polysaccharide-sterol derivative, is also soluble therein, wherein, in general, an aprotic solvent, such as dimethylformamide, dimethyl sulfoxide, formamide, dioxane and tetrahydrofuran, may favorably be employed. While the reaction temperature and the reaction duration may adequately be selected in accordance with each specific polysaccharide, the solvent and so on used and in dependence on the condition of progress of the reaction, it is preferable to effect the reaction at a temperature in the range from 0 to 200 °C for a duration of about 1 - 48 hours.

The charging amounts of the polysaccharide and of the compound having a steryl group at one terminal end and an isocyanato group at the other terminal end of the molecule may be in any proportion, wherein the rate of introduction of the steryl group into the polysaccharide can pertinently be controlled by varying the charging ratio. It is favorable for introducing the steryl group into the polysaccharide at a proportion of 0.01 - 20 steryl groups per 100 monosaccharide units constituting the polysaccharide, that the compound having a steryl group at one terminal end and an isocyanato group at the other terminal end of the molecule is charged in an amount corresponding to a

proportion of 0.01 - 30 molecules of the compound per 100 monosaccharide units constituting the polysaccharide.

For purifying the resulting polysaccharide-sterol derivative, purification techniques including re-precipitation, chromatographic separation and dialysis may favorably be employed. For realizing drying, there may favorably be employed freeze-drying and vacuum drying.

For the polysaccharide-sterol derivative to be used according to the present invention, any one may be used including not only those given above, but also those known ones produced by introducing steryl group into a polysaccharide. The polysaccharide-sterol derivative to be incorporated in the cosmetic product according to the present invention may be not only those which are produced by the process described above but also those which are produced by any other voluntary process. In such cases, it is favorable to use a polysaccharide-cholesterol derivative in which the steryl group is introduced into the polysaccharide at a proportion of 0.01 - 20 steryl groups, preferably 0.05 - 15 steryl groups, more preferably 0.1 - 10 steryl groups, per 100 monosaccharide units constituting the polysaccharide, since it is superior not only in the ability of retaining water due to the hygroscopic and moisture-preserving functions but also in the function of facilitating and stabilizing lamella formation together with superior film-forming ability.

While there is no special limitation in the

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molecular weight of the polysaccharide-sterol derivative according to the present invention, it is favorable to use, for cosmetic products for skin care, those which have weight-average molecular weights in the range from 10,000 to 500,000, preferably from 30,000 to 300,000, since they are superior in the effect of improving the moisture preservation and rough skin prevention. For the cosmetic products for hair care, those which have weight-average molecular weight in the range from 10,000 to 500,000, preferably from 30,000 to 300,000, are preferred, since they are superior in the protection effect due to the film-forming ability and in the stability of the product. For the products for rouge, those which have weight-average molecular weights in the range from 10,000 to 1,000,000, preferably from 30,000 to 500,000, are preferred.

Most favorable polysaccharide-sterol derivatives to be used according to the present invention, in view of easiness in formulation with cosmetic ingredients, are pullulan-cholesterol derivatives obtained by reacting a pullulan having a weight-average molecular weight about in the range from 10,000 to 1,000,000, preferably from 30,000 to 500,000, with a compound having a cholesteryl group at one terminal end and an isocyanato group at the other terminal end of the molecule, in such a way that the cholesteryl group is introduced in a proportion of 0.01 - 20 groups, preferably 0.05 - 15 groups, more preferably 0.1 - 10 groups, per 100 monosaccharide units constituting the

pullulan.

The cosmetic products according to the present invention comprise the polysaccharide-sterol derivative and cosmetic ingredients, wherein there is no restriction in their kinds, forms and so on and any product of any kind and form known from the past may be used. Concrete examples of the cosmetic products include skin-care cosmetics, make-up cosmetics and hair conditioning cosmetics.

As the materials for the cosmetic product to be used according to the present invention, known materials for cosmetic products compounded in conventional cosmetic products can be used without any restriction under a pertinent selection in accordance with each specific cosmetic product contemplated. Concrete examples of the materials for the cosmetic products include oils, moisture-preserving agent, UV absorber, beauty whitening agent, moisture-preserving agent, antioxidant, antiseptic, powder, pearly-lustering agent, inorganic pigments, organic pigments, dyestuffs, coloring agents, surfactants, thickening agent, stabilizers, dispersant, antiseptic, sterilizer, thickening agent, plasticizer, medicaments, fragrances, resins, water and pH regulator.

The cosmetic product according to the present invention may favorably contain the cosmetic materials in a proportion of 50 - 99.999 % by weight, preferably 70 - 99.99 % by weight, and the polysaccharide-sterol derivative in a proportion of 0.001 - 50 % by weight, preferably 0.01 - 30 % by weight, with respect to the

total amount of the cosmetic product.

Below, the cosmetic products according to the present invention will be described in more detail for ① general description of cosmetics, ② make-up cosmetics, ③ cosmetic products for rouge, ④ cosmetic products for hair conditioning and ⑤ cosmetic products for manicure, in this order. However, the cosmetic products according to the present invention are not restricted to these given below but encompass cosmetics of every form.

① General description of cosmetics

The cosmetic products according to the present invention are those in which the above-mentioned polysaccharide-sterol derivative is admixed to commonly known cosmetic products in a known practice. There is no limitation as to the morphologic state of the cosmetic product and quite superior effects may be brought about in any form of cosmetic product. For concrete examples of cosmetics, there may be recited white powdery cosmetics, such as powder foundation, powders for compacts, two-way cake and face powder; local cosmetics, such as eye shadow, powder brush, mascara, lipstick, lipgloss, lip-pencil, eye liner and eyebrow-pencil; emulsified products, such as emulsified foundation and make-up base; partial base cosmetics, such as powder pack, cleansing pack, sun-screen cream, creams, hand cream, sweat-suppressing agent and beauty wash lotion; and whole body products, such as baby powder and body powder. Others may be recited, for

example, cosmetics for skin care; products for hair treatment, such as hair forming agent, shampoo, rinse, rinse-in-shampoo, hair-shaping lotion, hair spray, hair mousse, hair cream, hair blow and hair oil; and manicures, such as nail enamel.

As the cosmetic products in which the polysaccharide-sterol derivative is used particularly favorably, there may be exemplified skin care products, such as beauty wash, milky lotion, cream and oil; make-up cosmetics, such as foundation, eye liner, mascara, eyebrow, rouge, cheek rouge and undercoat; and hair care products, such as gel, mousse, spray and hair cream.

In the cosmetic product according to the present invention, cosmetic compounding materials mentioned above to be used in conventional cosmetic products may be incorporated within the range not obstructing the effect of the present invention in accordance with each specific purpose. For the oils, there may be used, for example, hydrocarbon oils, such as squalane, liquid paraffin, vaseline, micro-clistalline wax, ozocerite and ceresine; higher fatty acids, such as myristic acid, palmitic acid, stearic acid, oleic acid, isostearic acid and behenic acid; higher alcohols, such as cetyl alcohol, stearyl alcohol, oleyl alcohol and batyl alcohol; esters, such as cetyl-2-ethyl hexanoate, 2-ethylhexyl palmitate, 2-octyldodecyl myristate, neopentylglycol-2-ethyl hexanoate, trioctanoic acid glyceride, 2-octyldodecyl oleate, isopropyl myristate, myristyl myristate,





carboxylic acid salt, chitin, urea and chitosan; UV absorbers; and beauty-whitening agent.

Further, it is also permissible to incorporate, each in an adequate proportion, for example, antioxidant, such as tocopherol, butylhydroxyanisole or dibutylhydroxytoluene; an antiseptic agent, such as methylparaben, ethylparaben, propylparaben or butylparaben; powdery additives, such as mica, bentonite, kaolin, talc, mica titanium, bismuth oxychloride and silicic acid anhydride; a pearling agent, such as guanine, pearling laminating resin or pearling agent based on mica-titanium; inorganic pigments, such as ultramarine, chromium oxide and cobalt blue; dyestuffs, such as Sudan III, Quinizarin Green SS and Quinoline Yellow SS; a surfactant, such as that based on Span, based on Tween, based on polyalkyl ether, based on polyoxyethylene-polyoxypropylene, based on fatty acid glyceride or based on polyoxyethylene-glycerin fatty acid ester; a thickening agent, such as carboxyvinyl polymer; medicaments, such as anti-inflammatory agent, vitamins and hormones; and perfumes.

It is furthermore permissible to incorporate, for example, polymers for setting, such as polyvinylpyrrolidone, PVP-VA, vinylmethyl ether/maleic anhydride copolymer, vinyl acetate/crotonic acid copolymer, vinylpyrrolidone/N,N-dimethylaminoethyl methacrylate copolymer diethyl sulfate, N-methacroyloxyethyl-N,N-dimethylammonium/N- $\alpha$ -methylcarboxybetaine/alkylmethacrylate copolymer, vinylpyrrolidone/stearyl acrylate/stearyloxyethyl-N,N-dimethylamine copolymer.

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The polysaccharide-sterol derivative to be incorporated according to the present invention is superior in the film-forming ability due to the presence of polysaccharide segment. Moreover, by using the polysaccharide-sterol derivative according to the present invention in combination with a volatile oil, a coating film can be formed, which does reveal no adherent touch feel after being dried and will not show any tendency to cause transcription onto material brought into contact therewith. As the volatile oil, known volatile oils may be used without limitation, for example, light isoparaffin, decamethylpentacyclosiloxane, hexamethyltricyclosiloxane, dimethylpolysiloxane, methylphenylpolysiloxane and organic perfluorocompounds. When the polysaccharide-sterol derivative is compounded in a skin-care or a make-up product, a large effect for improving the preservativity of the dressed state therewith, since a coating film exhibiting higher water-resistant and oil-resistant properties as compared with a coating film formed by a known cosmetic product containing trimethylsiloxy silicic acid can be formed, so that it can be used for all cosmetic products as a cosmetic raw material having ability of general use.

Thus, the polysaccharide-sterol derivative can be used for any form of cosmetic products employed conventionally. As favorable cosmetic products, there may be enumerated, for example, those in which the polysaccharide-sterol derivative is dissolved in a low-boiling cyclic silicone or in a hydrocarbon based

on low-boiling isoparaffin, both used as solvent for cosmetics; skin-care cosmetics in which the polysaccharide-sterol derivative is incorporated in a form of emulsion using a water-soluble polyhydric alcohol or using an emulsifying agent of non-ionic, anionic or cationic nature; cosmetics for rouge made of a composition in which the polysaccharide-sterol derivative is incorporated by being compounded with a solvent for cosmetics, such as a low viscosity silicone; cosmetics for mascara in which the polysaccharide-sterol derivative is incorporated by being compounded in a composition containing, for example, gum arabic, hydroxycellulose, bees wax and black iron oxide; and cosmetics for hair conditioning.

The cosmetic products according to the present invention can be formulated into an emulsified composition of a type of either oil-in-water or water-in-oil by compounding the polysaccharide-sterol derivative, oily components, water-soluble components, purified water and a surfactant and applying techniques of emulsification, solubilization and dispersion within the range not obstructing the purpose of the present invention.

There is no restriction as to the form of the cosmetic products according to the present invention and any voluntary form is permitted, for example, liquid, cream, gel, solid, powder, stick, spray, mousse, aerosol and roll-on type.

The polysaccharide-sterol derivative may be incorporated in the cosmetic product according to the

present invention in any voluntary proportion so long as the purpose of the present invention is not obstructed, while it is favorable to incorporate it in a proportion in the range from 0.001 to 50 %, preferably from 0.01 to 30 %, based on the total weight of the cosmetic product, since the moisture-retaining ability due to the hygroscopic and moisture-preserving functions will be high and the lamella-formaing and stabilizing effects are superior at such a proportion together with an effect of suppressing oily touch feel on the skin to a lower degree due to the superior film-forming ability.

② Make-up cosmetics

The cosmetic product according to the present invention is superior especially for using as a make-up cosmetic. As the make-up cosmetic, those of various forms which are constituted of powdery ingredients and oily ingredients may be recited, wherein there is no special limitation as to the product form, the compounding proportion and so on. There may be recited, for example, solid foundation, powder type foundation, oily foundation, sun-screen foundation, dressing base coat, face powder, cheek rouge, mascara, eye shadow and lip rouge. Emulsified foundations based on emulsifying systems may also be recited. Characteristic feature of the make-up cosmetics resides in a higher content of inorganic powder, such as talc, kaolin, iron oxide, titanium oxide and pearling pigment based on titanium-mica; and organic pigment, such as polyamide (nylon), cellulose and tar-based pigments.

The make-up cosmetics may be obtained conveniently in such a manner that the polysaccharide-sterol derivative is admixed to or incorporated as an alternative component in a cosmetic formulation known conventionally for a make-up cosmetic, in an adequate manner.

For the polysaccharide-sterol derivative to be incorporated in make-up cosmetic product, any one can be used so long as it is a polysaccharide sterol derivative, while those having weight-average molecular weights in the range from 10,000 to 500,000, preferably from 30,000 to 300,000, may be desirable. The content of the polysaccharide-sterol derivative may favorably be in the range from 0.001 to 50 % by weight and most preferably be in the range from 0.01 to 20 % by weight.

The polysaccharide-sterol derivative may be compounded together with a volatile oil. In this way, a make-up cosmetic product is obtained, which is in particular highly extensible and has a crispy feel when applied and which is very excellent in the dressing durability and in the prevention of secondary adhesion. When the amount of steryl group introduced in the polysaccharide-sterol derivative is short of the proportion of 0.01 group per 100 monosaccharide units constituting the polysaccharide, satisfactory result with respect to the improvement of dressing durability and to the reduction of secondary adhesion to clothing may not be attained. When the content of the polysaccharide-sterol derivative is short of 0.001 % by weight, almost no effect for improving the dressing

durability and for reducing the secondary adhesion onto clothing is realized. On the other hand, when the content of the polysaccharide-sterol derivative exceeds over 50 % by weight, the effect for improving the dressing duration and for reducing the secondary adhesion onto clothing may not much increased and will result in reduction in the application performance, such as "extension" of the make-up cosmetic upon the application, so that the fundamental function as a cosmetic is unfavorably obstructed. For preserving the film-forming ability suitably, the content of the polysaccharide-sterol should preferably be in the range from 0.001 to 50 % by weight.

There is no special restriction for the volatile oil to be used in the make-up cosmetic product according to the present invention and there may be enumerated, for example, light isoparaffin, decamethylpentacyclosiloxane, octamethyltetracyclosiloxane, hexamethyltricyclosiloxane, dimethylpolysiloxane, methylphenylpolysiloxane and organic perfluorocompounds. Preference is given to volatile hydrocarbon oils having boiling point at normal pressure in the range from 60 to 160 °C.

It is favorable that the content of the volatile oil is in the range from 1 to 90 %, preferably from 5 to 50 %, based on the total weight of the cosmetic product. When the content is short of 1 % by weight, expected effect of increasing the dressing durability and reducing the secondary adhesion is not realized and, on the other hand, when the content is in

excess of 90 % by weight, the proportion of the other components necessary for constituting the cosmetic product, such as powdery ingredients, become unfavorably lower and the function as the make-up cosmetic will be lost.

In a make-up cosmetic, oil ingredients, surfactant, colorant, powdery ingredients, waxes, UV absorber, moisture-retaining agent, medicinal ingredients, perfume and stabilizer, which are used conventionally in general for the formulation of make-up cosmetic, may be compounded within the range not obstructing the quality of the cosmetic, such as stability in appearance, viscosity and stiffness.

As the oily ingredients to be used in make-up cosmetic products according to the present invention, there may be recited, for example, liquid oils, solid greases, waxes, hydrocarbon oils, synthetic ester oils and silicone oils. Concrete examples of liquid oils include avocado oil, camellia oil, turtle oil, macadamia nut oil, maize oil, mink oil, olive oil, rapeseed oil, yolk oil, sesame oil, persic oil, wheat germ oil, sazanqua oil, castor oil, linseed oil, sufflower oil, cotton seed oil, perilla oil, soybean oil, peanut oil, tea tree seed oil, kaya oil, rice bran oil, China wood oil, tung oil, jojoba oil, germ oil, triglycerol, trioctanoic acid glyceride and triisopalmitic acid glyceride. As solid greases, there may be recited, for example, cacao butter, coconut butter, horse grease, hardened coconut oil, palm oil, tallow, sheeps grease, hardened tallow, palm kernel oil,



lard, bovine bone oil, sumac nut oil, hardened oils, bovine leg oil, sumac wax and hardened castor oil. As waxes, there may be recited, for example, beeswax, candelilla wax, cotton wax, carnauba wax, bayberry wax, insect wax, spermaceti, montan wax, rice-bran wax, lanolin, kapok oil, lanolin acetate, liquid lanolin, sugar cane wax, lanolin fatty acid isopropyl, hexyl laurate, reduced lanolin, jojoba wax, hard lanolin, shellac wax, polyoxyethylene-lanolin alcohol ether, polyoxyethylene-lanolin alcohol acetate, polyoxyethylene-cholesterol ether, lanolin fatty acid polyethylene glycol and polyoxyethylene hydrogenated lanolin alcohol ether. As the hydrocarbon oils, there may be recited, for example, liquid paraffin, ozokerite, squalene, pristane, paraffin, ceresine, squalene, vaseline and microcrystalline wax. As synthetic ester oils, there may be recited, for example, isopropyl myristate, cetyl octanoate, octyl dodecyl myristate, isopropyl palmitate, butyl stearate, hexyl laurate, myristyl myristate, decyl oleate, hexyl decyl dimethyloctanoate, cetyl lactate, myristyl lactate, lanolin acetate, isocetyl stearate, isocetyl isostearate, cholesteryl 12-hydroxystearate, ethylene glycol di-2-ethylhexanoate, dipentaerythritol fatty acid esters, N-alkylglycol monoisostearate, neopentylglycol dicaprate, diisostearyl malate, glycerol di-2-heptylundecanoate, trimethylolpropane tri-2-ethylhexylate, trimethylolpropane triisostearate, pentane-erythritol tetra-2-ethylhexylate, glycerol tri-2-ethylhexylate, trimethylolpropane triisostearate, cetyl

2-ethylhexanoate, 2-ethylhexyl palmitate, glycerol tri-myristate, tri-2-heptylundecanoic acid glyceride, castor oil fatty acid methyl ester, oleic acid oil, cetostearyl alcohol, acetoglyceride, 2-heptylundecyl palmitate, diisobutyl adipate, N-lauroyl-L-glutamic acid 2-octyldodecyl ester, di-2-heptylundecyl adipate, ethyl laurate, di-2-ethylhexyl sebacate, 2-hexyldecyl myristate, 2-hexyldecyl palmitate, 2-hexyldecyl adipate, diisopropyl sebacate, 2-ethylhexyl succinate, ethyl acetate, butyl acetate, amyl acetate and triethyl citrate. As silicone oils, there may be recited, for example, linear polysiloxanes, such as dimethyl polysiloxane, methyl phenyl polysiloxane and methyl hydrogen polysiloxane; cyclic polysiloxanes, such as decamethyl polysiloxane, dodecamethyl polysiloxane and tetramethyl tetrahydrogen polysiloxane; silicone resins having three dimensional reticular structure; and silicone rubbers.

There is no special limitation for the surfactant to be employed in make-up cosmetic products according to the present invention and, for example, oleophilic non-ionic surfactants and hydrophilic non-ionic surfactants can be employed. As oleophilic non-ionic surfactants, there may be recited, for example, sorbitan fatty acid esters, such as sorbitan monooleate, sorbitan monoisostearate, sorbitan monolaurate, sorbitan monopalmitate, sorbitan monostearate, sorbitan sesquioleate, sorbitan trioleate, diglycerol sorbitan penta-2-ethylhexylate, diglycerol sorbitan tetra-2-ethylhexylate; glycerol

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fatty acid esters, such as glycerol mono(cottonseed oil fatty acid) ester, glycerol monoerucate, glycerol sesquioleate, glycerol monostearate, glycerol  $\alpha$ ,  $\alpha'$ -oleic acid pyroglutamic acid ester, glycerol monostearate and glycerol malate; propylene glycol fatty acid esters, such as propylene glycol monostearate and the like; and others including hardened castor oil derivatives, glycerol alkyl ethers and so on.

As the hydrophilic non-ionic surfactants, there may be enumerated, for example, polyoxyethylene sorbitan fatty acid esters, such as polyoxyethylene-sorbitan monooleate, polyoxyethylenesorbitan monostearate, polyoxyethylenesorbitan monooleate and polyoxyethylenesorbitan tetraoleate; polyoxyethylene-sorbitol fatty acid esters, such as polyoxyethylene-sorbitol monolaurate, polyoxyethylenesorbitol monooleate, polyoxyethylene sorbitol pentaoleate and polyoxyethylene monostearate; polyoxyethylene glycerol fatty acid esters, such as polyoxyethylene glycerol monostearate, polyoxyethylene glycerol monoisostearate and polyoxyethylene glycerol triisostearate; polyoxyethylene fatty acid esters, such as polyoxyethylene monooleate, polyoxyethylene distearate, polyoxyethylene monodioleate and ethylene glycol cis-stearate; polyoxyethylene alkyl ethers, such as polyoxyethylene lauryl ether, polyoxyethylene oleyl ether, polyoxyethylene stearyl ether, polyoxyethylene behenyl ether, polyoxyethylene 2-octyldodecyl ether and polyoxyethylene cholestanol ether; polyoxyethylene alkyl phenyl ethers, such as polyoxyethylene octyl phenyl

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ether, polyoxyethylene nonyl phenyl ether and polyoxyethylenedininonyl phenyl ether; Pluronic types, such as Pluronics; polyoxyethylene-polyoxypropylene alkyl ethers, such as polyoxyethylene-polyoxypropylene cetyl ether, polyoxyethylene-polyoxypropylene 2-decyltetradecyl ether, polyoxyethylene-polyoxypropylene monobutyl ether, polyoxyethylene-polyoxypropylene hydrogenated lanolin and polyoxyethylene-polyoxypropylene glycerol ether; tetrapolyoxyethylene-tetrapolyoxypropylene ethylenediamine condensation products, such as Tetronics; polyoxyethylene-hydrogenated castor oil derivatives, such as polyoxyethylene castor oil, polyoxyethylene-hydrogenated castor oil, polyoxyethylene-hydrogenated castor oil monoisostearate, polyoxyethylene-hydrogenated castor oil triisostearate, polyoxyethylene-hydrogenated castor oil monopyroglutamic acid monoisostearic acid diester and polyoxyethylene-hydrogenated castor oil maleate; polyoxyethylene-beeswax-lanolin derivatives, such as polyoxyethylene-sorbitol beeswax and the like; alkanolamides, such as palm oil fatty acid diethanolamide, lauric acid monoethanolamide and fatty acid isopropanolamides; and others including polyoxyethylene-propylene glycol fatty acid esters, polyoxyethylene alkylamines, polyoxyethylene fatty acid amides, sucrose fatty acid esters, polyoxyethylene-nonylphenyl formaldehyde condensation products, alkylethoxydimethylamine oxides and trioetyl phosphate.

As the powdery ingredients to be incorporated in meke-up cosmetic products according to the present

invention, known ones employed usually for make-up cosmetics can be used without limitation. Concrete examples include inorganic powdery substances, such as talc, kaolin, mica, sericite, muscovite, phlogopite, lepidlite, biotite, lithia mica, vermiculite, magnesium carbonate, calcium carbonate, aluminum silicate, magnesium metasilicate aluminate, barium silicate, calcium silicate, magnesium silicate, strontium silicate, metal salts of wolframate, magnesium, silica, zeolites, barium sulfate, calcined calcium sulfate (calcined gypsum), calcium phosphate, fluorapatite, hydroxyapatite, ceramic powder, metal soaps (zinc myristate, calcium palmitate, aluminum stearate and so on) and boron nitride; oranic powdery materials, such as polyamide powder (powdery nylons), polyethylene powder, polymethylmethacrylate powder, polystyrene powder, powdery product of copolymer resin of styrene and acrylic acid, powder of benzoguanamine resin, polytetrafluoroethylene powder and cellulose powder; inorganic white pigments, such as titanium dioxide and zinc oxide; inorganic red pigments, such as iron oxide (red iron oxide), iron titanate; inorganic brown pigments, such as  $\gamma$ -iron oxide etc.; inorganic yellow pigments, such as yellow iron oxide and loess; inorganic black pigments, such as black iron oxide, carbon black and titanium lower oxides; inorganic purple pigments, such as mango violet and cobalt violet; inorganic green pigments, such as chromium oxide, chromium hydroxide and cobalt titanate; inorganic blue pigments, such as ultramarine and prussian blue;

pearling pigments, such as titanium oxide-coated mica, titanium oxide-coated bismuth oxychloride, titanium oxide-coated talc, colored titanium oxide-coated mica, bismuth oxychloride and scale flake; powder metal pigments, such as aluminum powder and copper powder; organic pigments, such as Red 201, Red 202, Red 204, Red 205, Red 220, Red 226, Red 228, Red 405, Orange 203, Orange 204, Yellow 205, Yellow 401 and Blue 404; organic pigments, for example, zirconium-, barium- and aluminum-lakes, such as Red 3, Red 104, Red 106, Red 227, Red 230, Red 401, Red 505, Orange 205, Yellow 4, Yellow 5, Yellow 202, Yellow 203, Green 3 and Blue 1; and natural pigments, such as chlorophyll and  $\beta$ -carotin. Also powders may be employed, in which the surfaces of the powder particles are subjected to a hydrophobicating treatment in a usual manner by, for example, silicone resin treatment, wax treatment, dextrin-fatty acid treatment and fluorine treatment.

As waxes to be incorporated in make-up cosmetic products according to the present invention, known waxes used in make-up cosmetics can be used without any limitation. Concrete examples include beeswax, candelilla wax, cotton wax, carnauba wax, bayberry wax, insect wax, spermaceti, montan wax, rice-bran wax, lanolin, kapok wax, lanolin acetate, liquid lanolin, sugarcane wax, lanolin fatty acid isopropyl, hexyl laurate, reduced lanolin, jojoba wax, hard lanolin, shellac wax, polyoxyethylene lanolin alcohol ether, polyoxyethylene lanolin alcohol acetate, polyoxyethylene cholesterol ether, lanolin fatty acid polyethylene

glycol and polyoxyethylene hydrogenated lanolin alcohol ether, ceresine, vaseline and microcrystalline wax. In general, the content of wax may favorably be 1 - 30 %, based on the total weight of the make-up cosmetic product.

As the UV absorber to be incorporated in make-up cosmetic products according to the present invention, known UV absorbers used for make-up cosmetics may be employed without any limitation. Concrete examples include UV absorbers based on benzoic acid, such as paraaminobenzoic acid (in the following, abbreviated as PABA), PABA monoglycerol ester, N,N-dipropoxy-PABA ethyl ester, N,N-diethoxy-PABA ethyl ester, N,N-dimethyl-PABA butyl ester, N,N-dimethyl-PABA methyl ester; UV absorbers, based on anthranilate, such as homomenthyl-N-acetyl anthranilate and so on; UV absorbers based on salicylate, such as amyl salicylate, menthyl salicylate, homomenthyl salicylate, octyl salicylate, phenyl salicylate, benzyl salicylate and p-isopropanolphenyl salicylate; UV absorbers based on cinnamate, such as octylmethoxy cinnamate, ethyl-4-isopropyl cinnamate, methyl-2,5-diisopropyl cinnamate, ethyl-2,4-diisopropyl cinnamate, methyl-2,4-diisopropyl cinnamate, propyl-p-methoxy cinnamate, isopropyl-p-methoxy cinnamate, isoamyl-p-methoxy cinnamate, octyl-p-methoxy cinnamate (2-ethylhexyl-p-methoxy cinnamate), 2-ethoxyethyl-p-methoxy cinnamate, cyclohexyl-p-methoxy cinnamate, ethyl- $\alpha$ -cyano- $\beta$ -phenyl cinnamate, 2-ethylhexyl- $\alpha$ -cyano- $\beta$ -phenyl cinnamate and glyceryl-mono-2-ethylhexanoyl-diparamethoxy cinnamate; UV

absorbers based on benzophenone, such as 2,4-dihydroxybenzophenone, 2,2'-dihydroxy-4-methoxybenzophenone, 2,2'-dihydroxy-4,4'-dimethoxybenzophenone, 2,2',4,4'-tetrahydroxybenzophenone, 2-hydroxy-4-methoxybenzophenone, 2-hydroxy-4-methoxy-4'-methylbenzophenone, 2-hydroxy-4-methoxybenzophenone-5-sulfonic acid salts, 4-phenylbenzophenone, 2-ethylhexyl-4'-phenylbenzophenone-2-carboxylate, 2-hydroxy-4-n-octoxybenzophenone and 4-hydroxy-3-carboxybenzophenone; and 3-(4'-methylbenzylidene)-d,l-camphor, 3-benzylidene-d,l-camphor, urocanic acid, urocanic acid ethyl ester, 2-phenyl-5-methylbenzoxazole, 2,2'-hydroxy-5-methylphenylbenzotriazole, 2-(2'-hydroxy-5'-tert-octylphenyl)benzotriazole, 2-(2'-hydroxy-5'-methylphenyl)benzotriazole, dibenzal azine, dianisoylmethane, 4-methoxy-4'-tert-butylidibenzoylmethane and 5-(3,3-dimethyl-2-norbornylidene)-3-pentane-2-one.

As the moisture-preserving ingredients to be incorporated in make-up cosmetic products according to the present invention, known ones used in make-up cosmetics can be employed without any limitation. Concrete examples include polyethylene glycol, propylene glycol, glycerin, 1,3-butylene glycol, xylitol, sorbitol, maltitol, chondroitin sulfuric acid, hyaluronic acid, mucoitin sulfuric acid, caronic acid, atherocollagen, cholesteryl-12-hydroxystearate, sodium lactate, salts of bile acid, dl-pyrrolidone carboxylic acid salts, soluble short-chain collagen, diglycerol-(ethylene oxide)-propylene oxide adduct, *Rosa roxburghii* glabra extract, extract of *Achillea*



millefolium and melilote extract.

As the medicinal ingredients to be incorporated in make-up cosmetic products according to the present invention, known ones used for make-up cosmetics can be employed without any limitation. Concrete examples include blood circulation promoters, such as nonylic acid valerylamide, nicotic acid benzyl ester, nicotic acid  $\beta$ -butoxyethyl ester, capsaicine, zingerone, cantharis tincture, ichthammol, caffeine, tannic acid,  $\alpha$ -borneol, tocopherol nicotinate, inositol hexanicotinate, cyclandelate, cinnarizine, tolazoline, acetylcholine, verapamil, cepharanthin and  $\gamma$ -oryzanol; antimycotic agents, such as clotrimazole, pentachlorophenol, trichlorophenol caproate, tribromophenol caproate, lauryltriphenylphosphonium bromide, diantazole hydrochloride, p-acethylaminophenyl rhodan, thimerosal, undecylenic acid, zinc undecylenate, dermacid, valithion, pullolnitron, siccanin, miconazole, econazole, isoconazole, sulconazole, thioconazole, bifonazole, oxyconazole, ketoconazole, ciclopiroxolamine, torciclate, naphtifin, griseofulvin and 5-fluorocytosine; and whiting beauty agent, such as arubtin, kojic acid, placenta extract and vitamin C and derivative thereof.

The polysaccharide-sterol derivative to be employed according to the present invention exhibits an ultraviolet ray absorbing function in the wave length range originated from that of the constituent sterol and reveals, when solubilized in a specific medium to be incorporated as a compoment of the cosmetic product,

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a water-repellent property, a lubricity and a gloss-imparting ability. It is very useful as a coating film forming ingredient for a raw material of the cosmetic product, since it has at the same time a better coating film-forming ability due to the polysaccharide segment, so that this characteristic feature may be made use of, when pertinent form of make-up cosmetic is chosen.

③ Cosmetic products for lip rouge

The cosmetic product according to the present invention is especially superior also for use as lip rouge cosmetic. The lip rouge cosmetic product according to the present invention can be incorporated in any type of lip rouge or as a raw material in any type of lip rouge. The cosmetic product for lip rouge according to the present invention is constituted of, in addition to the polysaccharide-sterol-derivative, cosmetic ingredients employed in general, such as waxes, liquid oils, pigments, pearling agent and so on. They can be processed into a lipstick by shaping in a form of rod or, alternatively, can be formed into a lip rouge in a form of a dish permitting precise drawing of lip contour using a drawing tool by being formed within a metal pan. While such lip rouge cosmetics are made predominantly of oily ingredients, they may contain further a volatile solvent, such as a volatile silicone or volatile hydrocarbon; and a coating film-forming ingredient, such as a wax or an organic silicone resin. It is furthermore possible to formulate the lip rouge cosmetic in a form of an emulsion lip rouge by blending water therewith or in a form of a

liquid lip rouge by blending a specific oily ingredient and a water-soluble substance with a water-in-oil type rouge. The cosmetic product for lip rouge may favorably be formulated also in a form of a paste or a liquid of a type of water-in-oil. By admixing the polysaccharide-sterol derivative adequately to any type of lip rouge known hitherto or by formulating it as an alternative component therewith, it is able to obtain a cosmetic product for lip rouge, in which the dressed film is strengthened, adherent touch feel is excluded, color-transference phenomenon is improved and the dressed film is lustrous so that the cosmetic function as a lip rouge is improved so as to impart a wet feel to the lip. The cosmetic product for lip rouge according to the present invention can be used in any composition or in any form, so long as the polysaccharide-sterol derivative is contained. As one of favorable example, a water-in-oil type cosmetic product for lip rouge of a form of liquid or paste is recited, in which a volatile silicone oil, a polysaccharide-sterol derivative and an organo-modified clay mineral are incorporated in an oily component and, at the same time, a surfactant based on polyoxyalkylene-modified organopolysiloxane as a dispersant for powder is incorporated. Such a water-in-oil type cosmetic product for lip rouge can be used so as to permit to draw smoothly the lip contour precisely when a drawing tool is used. It is better in the application performance and in the placticability with better stability and will result in a lustrous coating film exhibiting no

color transference and revealing durable dressing without deteriorating wetness of the lip.

The cosmetic materials for lip rouge can be formulated into any cosmetic product for lip rouge of any voluntary composition so long as it contains the polysaccharide-sterol derivative, wherein a favorable example of the composition of lip rouge cosmetic product comprises 5 - 60 % by weight of a volatile silicone oil, 0.001 - 50 % by weight of a polysaccharide-sterol derivative, 0.1 - 15 % by weight of a surfactant based on polyoxyalkylene-modified organopolysiloxane, 0.1 - 7 % by weight of an organo-modified clay mineral, 2 - 60 % by weight of water and 2 - 40 % by weight of a powdery ingredient for cosmetic use.

As the volatile silicone oil, there may favorably be recited among cyclic and linear dimethylpolysiloxanes those exhibiting high volatilizing velocity at normal temperature. As the cyclic dimethylpolysiloxane, there may be recited, for example, octamethylcyclotetrasiloxane [abbreviated hereinafter to cyclic silicone (tetramer)] and decamethylcyclopentasiloxane [abbreviated in the following to cyclic silicone (pentamer)]. As the linear dimethylpolysiloxane, there may be exemplified those having a viscosity at 25 °C of 5 mm<sup>2</sup>/sec or less. For the volatile silicone oil, it is permissible to use linear one and cyclic one in combination. It is favorable that the content of the volatile silicone oil is in the range from 5 to 60 % by weight, preferably from 10 to 50 % by weight. When the content is less

than 5 % by weight, the cosmetic product for lip rouge will have higher viscosity and may sometimes become difficult to realize application using a drawing tool, resulting in a deterioration in the application performance, though may occasionally be usable without problem. When the content is greater than 60 % by weight, there may sometimes occur irritation by the volatile silicone oil on skin unfavorably in hygienic safety, though may occasionally permit use thereof without problem. When cyclic silicone oil is used, it is favorable to choose the proportion of the cyclic silicone (tetramer) relative to the cyclic silicone (pentamer) in the range from 8/2 to 2/8, though not restricted thereto only. When the proportion is in the above range, the product exhibits better stability at low temperatures with proper volatilizing velocity and may result in occasionally better application aspect.

For the polysaccharide-sterol derivative to be incorporated in the cosmetic product for lip rouge according to the present invention, any one can be employed so long as it is a polysaccharide-sterol derivative and the content thereof may also be selected in suitable manner. For the polysaccharide-sterol derivative, those which have number average molecular weights in the range from 10,000 to 1,000,000, preferably from 30,000 to 300,000, may be favorable. The content of the polysaccharide-sterol derivative may favorably be in the range from 0.001 to 50 % by weight, preferably from 0.01 to 20 % by weight. When the content is lower than 0.001 % by weight, the coating

film strength is lower and the durability of the dressing becomes deteriorated. When the content is greater than 50 % by weight, the cosmetic product for lip rouge may sometimes have too high a viscosity and deteriorate the application performance using a drawing tool. For maintaining the moisture-preservativity and the coating film-forming ability each at an adequate level, the content of the polysaccharide-sterol derivative may favorably be in the range from 0.001 to 50 % by weight.

The surfactant based on the polyoxyalkylene-modified organopolysiloxane (referred to hereinafter as POA-modified silicone) may sometimes be denoted as polyether-modified silicone or alkylpolyether-modified silicone and functions as an emulsifier or a dispersant. As the POA-modified silicone, there may favorably be used those which are in a form of liquid or paste, in particular, those which are insoluble in water, for example, SILICONE KF-945 A (trademark, a product of Shin-Etsu Chemical Co., Ltd.), SILICONE SH-3772 C and SILICONE SH-3775 C (both trademarks, products of Toray-Dow Corning Silicone K.K.) and ABIL WE-09 (trademark, a product of the firm Goldschmidt). These POA-modified silicones have each a main skeleton chain of polysiloxane and exhibit better compatibility with the volatile silicone and with the polysaccharide-sterol derivative present in the oil phase, so that a better powder dispersing stability may occasionally be expectable. There is no special limitation in the content of the POA-modified silicone, while a content

in the range from 0.1 to 15 % by weight, preferably from 0.5 to 10 % by weight, may be favorable. When the content is less than 0.1 % by weight, the function as a dispersant may become insufficient and may occasionally result in deterioration of stability. When the content is greater than 15 % by weight, the dressed coating film may sometimes suffer from collapse by sweat or so on and may result in deterioration of durability.

For the organo-modified clay mineral, any one which is used usually in cosmetic products can be incorporated. There may be exemplified those in which natural or synthetic clay minerals, such as montmorillonite, saponite, hectorite and bentonite, are modified by exchanging the ion-exchangeable cation therein with an organic polar compound or an organic cation. They may occasionally provide the oil phase, namely, the outer phase, with some structure which contributes to an increase in the stability of the cosmetic product. While there is no special limitation in the content thereof, a content in the range from 0.1 to 7 % by weight, preferably from 0.5 to 5 % by weight may be favorable. When the content is less than 0.1 % by weight, formation of the structure may occasionally not be attained and the stability may be deteriorated. When the content is greater than 7 % by weight, the cosmetic product for lip rouge may occasionally become stiffer, with the result of deterioration of the application performance using drawing tool.

While there is no special limitation in the content of water in the cosmetic product of lip rouge,

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a water content in the range from 2 to 60 % by weight, preferably from 4 to 50 % by weight may be favorable. When the content is less than 2 % by weight, it becomes not able to impart a wet feel to the lip and the lip becomes dry. When the content is greater than 60 % by weight, the proportion of the inner phase becomes too high, resulting in deterioration of the stability. It is permissible that the aqueous system of the inner phase contains, in addition to water, water-soluble ingredients, such as alcohols, polyhydric alcohols, acids, their salts, alkalis, water-soluble high molecular weight substances, coloring matters, moisture-preserving agent, antiseptics and water-soluble medicaments, under voluntary choice, each within a content not obstructing the effect of the present invention.

For the powdery ingredients for the cosmetic products, those which are used usually in cosmetics can be employed without any limitation. There may be compounded, for example, those which function not only as coloring materials for lip rouge but also as the agent for regulating drying velocity. Concrete examples of the powdery ingredients include extender pigments, such as talc, sericite, kaolin, mica, magnesium carbonate, calcium carbonate, magnesium silicate, magnesium aluminosilicate, silica and synthetic mica; white pigments, such as titanium oxide, zinc oxide and barium sulfate; inorganic coloring pigments, such as red iron oxide, yellow iron oxide, black iron oxide, ultramarine and prussian blue;



organic coloring pigments, such as tar pigment and so on; pearling pigments, such as mica titanium, iron oxide mica titanium and bismuth oxychloride; and organic powdery substances, such as nylon powder, silk powder, styrene powder and crystalline cellulose. In using in the cosmetic product according to the present invention, the inorganic powdery ingredients among those given above may occasionally be more favorable when they are subjected to a hydrophobicating surface treatment using an oil, a silicone or a fluoro-based compound, since thereby the dispersion of the inorganic powdery ingredient in the oil phase may be improved. When the blending proportion of powdery ingredient of lower hydrophobicity is higher, the stability of the cosmetic products for lip rouge may occasionally be decreased. While there is no special limitation in the content of the powdery ingredient for cosmetics, a content in the range from 2 to 40 % by weight, preferably from 5 to 30 % by weight, may be favorable. When the content is less than 2 % by weight, the drying velocity of the lip rouge may occasionally be decreased and the color development may also be reduced to thereby render it unadapted for use as lip rouge. When the content is greater than 40 % by weight, the viscosity will become too high to be spooned by a drawing tool and the dressed coating film may become nonuniform to render the beautiful appearance or the durability of the dressing deteriorated, though the drying velocity is increased.

It is possible to incorporate in the cosmetic

products for lip rouge according to the present invention ingredients which are liquid or semisolid at normal temperature as non-volatile ingredients other than the ingredients given above. For such non-volatile ingredients, oils and water-soluble substances used usually in cosmetic products may be recited, though not restricted thereto. Concrete examples of oils include liquid oils and semisolid oils of those based on hydrocarbon, based on ester, based on triglyceride and based on silicone, such as liquid paraffin, squalane, vaseline, polybutene, glyceryl trioctanoate, propylene glycol dicaprate, cetyl 2-ethylhexanoate, isocetyl stearate, dipentaerythritol fatty acid esters, jojoba oil, dimethylpolysiloxane and methylphenylpolysiloxane. As the water-soluble substances, there may be recited, for example, polyhydric alcohols, polyethylene glycol, polyglycerols and esters of them. It is possible to incorporate waxes, resins, tallows, fatty acids and higher alcohols, so long as the resulting composition mixed with the non-volatile ingredient is present in a form of liquid or semisolid at normal temperature. In case non-volatile ingredients are incorporated, the content thereof is not specifically restricted, while a preferred content may be in the range from 3 to 30 % by weight. By incorporating these ingredients, the luster and also the sealability of the dressed coating film may occasionally be improved, whereby the effect of maintaining the wet state of the lip can be increased.

It is possible to incorporate in the cosmetic products for lip rouge according to the present

invention ingredients which can be incorporated usually in cosmetic products, so long as the effect of the cosmetic product is not obstructed. There may be recited, for example, natural coloring materials, ultraviolet ray absorber, moisture-preserving agent, cool-feeling agent, antiseptic, antioxidant, surfactant, perfumes, medicinal ingredients, such as vitamins and hormones, oil-gelating agent and pH-regulator.

The morphological state of the cosmetic product for lip rouge according to the present invention is not specifically limited and any form is possible so long as it belongs to ones known hitherto. The form of the cosmetic product for lip rouge can voluntarily be chosen under provision of creative possibilities for the kind and content of each component to be compounded without any respect to those given above for the lip rouge cosmetics, so long as the polysaccharide-sterol derivative is contained.

④ Cosmetic products for hair conditioning

The cosmetic materials according to the present invention are in particular superior also for use as cosmetic products for hair conditioning. The polysaccharide-sterol derivative is constituted mainly of a polysaccharide and contains a large proportion of steryl group and, thus, has properties similar to a substance, such as an amino-modified silicone or the like, so that it provides better adsorption onto hair and is superior in the adhesion and in the resistance to washing together with superior effects of improving smooth combing and water-retentivity and of suppressing

occurrence of electrostatic charge on combing.

In case the cosmetic materials according to the present invention are used as a cosmetic product for hair conditioning, the contemplated cosmetic product for hair conditioning having a content of the polysaccharide-sterol derivative can be prepared by adding the polysaccharide-sterol derivative adaptively to, or incorporating it as an alternative component, in a formulation of components known usually for a cosmetic product for hair conditioning.

The polysaccharide-sterol derivative may be present in a soft consistency, such as that exhibited by a dimethylsiloxane of a high molecular weight of, for example, 400,000 - 700,000, and can form a soft and non-adherent coating film, even when the polysaccharide-sterol derivative has a high molecular weight of 20,000 to 50,000 or so, by controlling the content of the steryl group in the polysaccharide-sterol derivative. When the polysaccharide-sterol derivative is compounded in, for example, a coating agent for branched hair or a rinse-in-shampoo, such effects as repairing the branching portion of hair by binding together, improving smooth combing, preventing desquamation of cuticles from hair on brushing and preventing formation of branched hair and a hair lustering effect may be attained. These effects may assumably be revealed by formation of a coating film of the polysaccharide-sterol derivative on the surface of hair.

The cosmetic products for hair conditioning according to the present invention may be present in

any form without specifically respecting the form, so long as the form is known hitherto. The cosmetic products for hair conditioning according to the present invention may be made of a composition of various application types. They may be in forms of, for example, general hair conditioning products, shampoo products, rinse products, treatment products, setting products, permanent-waving liquid and mascara. They may have forms of liquid, cream, aqueous emulsion and gel.

The cosmetic products for hair conditioning according to the present invention may be composed solely of the polysaccharide-sterol derivative as polymeric component. It is also possible to use the polysaccharide-sterol derivative concurrently with a natural or synthetic polymeric component or a modified natural polymeric substance for hair conditioning known heretofore. It is further possible to use concurrently therewith a plasticizer, such as a higher fatty acid ester, glycerin or a polyethylene glycol. Further, it is also possible to use various additives concurrently, for example, surfactants, thickening substances, hydrotropes, emulsions, conditioners, oil and fats, moisture-preserving agents, coloring agents, antiseptics and perfumes.

If the cosmetic products for hair conditioning are shampoo, rinse, treatment agent, setting agent, permanent-waving agent and mascara, they may be prepared by adding the polysaccharide-sterol derivative to known compositions therefor in an amount of 0.001 % by weight or more, to use them as, for example, shampoo

or mascara, containing the polysaccharide-sterol derivative.

Particularly favorable application forms of the cosmetic products for hair conditioning according to the present invention include those of hair spray of aerosol type, hair spray of pump type, foaming aerosol, hair mist, set lotion, hair-styling gel, hair liquid, hair cream and hair oil, wherein they may be present in any voluntary form including those based on solubilization, based on emulsification, based on powder dispersion, based on two phases of oil/water and based on three phases of oil/water/powder. In the case of that based on emulsification, an oil phase containing the polysaccharide-sterol derivative is emulsified using an emulsifier of surfactant of, for example, non-ionic, cationic or anionic nature or of mixture thereof, to form a product based on emulsification. On the emulsification, it is also possible to form the emulsion in such a way that an emulsifier is dissolved in a water-soluble polyhydric alcohol, whereto an oil phase containing the polysaccharide-sterol derivative is added and the resulting mixture is emulsified to form an emulsified composition, whereupon the resulting composition is diluted with an aqueous phase containing a cationic resin. While it is possible to use the polysaccharide-sterol derivative as a surface active agent, it is quite indifferent to use a known emulsifier used usually.

As the emulsifier used for emulsification other than the polysaccharide-sterol derivative, any one may

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be used so long as it is known, for which there may be recited, for example, nonionic surfactants, such as polyoxyethylene alkyl ethers, polyoxyethylene alkyl phenyl ether, polyoxyethylene cholesteryl ether, polyoxyethylene sorbitan fatty acid esters, polyoxyethylene glyceryl fatty acid esters, polyoxyethylene hardened castor oil, polyethylene glycol fatty acid esters, polyglycerol fatty acid esters, sucrose fatty acid esters and polyether-modified silicones; cationic surfactants, such as stearyltrimethylammonium chloride, distearyldimethylammonium chloride, cetyltrimethylammonium chloride, behenyltrimethylammonium chloride and cetyl pyridinium chloride; and anionic surfactants, such as sodium cetyl sulfate, sodium polyoxyethylene lauryl ether sulfate, sodium lauryl sulfate, potassium salt of coconut oil fatty acid and sodium coconut oil fatty acid methyltaurate.

As the water-soluble polyhydric alcohols, there may be enumerated, for example, ethylene glycol, propylene glycol, 1,3-butylene glycol, 1,4-butylene glycol, dipropylene glycol, glycerol, diglycerol, triglycerol, tetraglycerol, glucose, maltose, maltitol, sucrose, fructose, xylitol, sorbitol, maltotriose, threitol, erythritol, starch, decomposed sugar reduced alcohol and hyaluronic acid. They can be used either alone or in combination of two or more of them.

As the polysaccharide-sterol derivative to be incorporated in the cosmetic products for hair conditioning, those having a weight-average molecular weight in the range from 10,000 to 1,000,000,

preferably from 10,000 to 500,000, may be favorable. The amount of steryl groups introduced in the polysaccharide-sterol derivative may favorably be in the range from 0.01 to 20 groups, preferably from 0.05 to 15 groups, more preferably from 0.1 to 10 groups, per 100 monosacchaside units constituting the polysaccharide. When the introduced proportion of the steryl groups is short of 0.01 group, the interaction with hair may in some cases become insufficient and the preservativity of the effect for preventing hair damage is deteriorated.

The content of the polysaccharide-sterol derivative in the entire mass of the cosmetic product for hair conditioning may favorably be in the range from 0.001 to 50 % by weight, preferably from 0.01 to 30 % by weight. When the content is short of 0.001 % by weight, the contemplated effect will not be attained sufficiently. When the content exceeds over 50 % by weight, it becomes difficultly soluble. For use as an agent for rinsing effect, it may favorably be in the range from 0.001 to 50 %, preferably from 0.01 to 30 %, based on the total weight of the cosmetic product for hair conditioning. When the content is short of 0.001 % by weight, sufficient effect may not be obtained and, when it exceeds over 50 % by weight, dissolution of the polysaccharide-sterol derivative becomes unfavorably disturbed. The content of the polysaccharide-sterol derivative may favorably be in the range from 0.001 to 50 % by weight, in order to maintain the water-retentivity and the coating film-forming ability



adequately.

On blending the polysaccharide-sterol derivative with the cosmetic materials for hair conditioning, it may be blended after having been dissolved in an oil of liquid form. It is of course possible to add it to any cosmetic material for hair conditioning isolately, before it is dissolved in the formulation system. As the oil of liquid form, there may be recited, for example, linear silicones, cyclic silicones and hydrocarbons based on isoparaffin. Concrete examples of the linear silicones include octamethylcyclotetra-siloxane, decamethylcyclopentasiloxane and tetradeca-methylcyclohexasiloxane.

As the hydrocarbons based on isoparaffin, those having boiling points at normal pressure in the range from 60 to 260 °C may be used. Concrete examples include ISOPAR A (trademark, a product of Exxon corp.), ISOPAR C (do.), ISOPAR D (do.), ISOPAR E (do.), ISOPAR G (do.), ISOPAR H (do.), ISOPAR K (do.), ISOPAR L (do.), and ISOPAR M (do.), SHELLSOL 71 (trademark, a product of Shell Oil Co.) and SORTOL 100, 130 and 220 (trademark, all are products of Phillips Petroleum Co.). The hydrocarbons based on isoparaffin may be used either solely of voluntary one or in a combination of two or more of them, wherein the content of total sum of the hydrocarbons based on isoparaffin may favorably be in the range from 1 to 50 times weight the polysaccharide-sterol derivative and may preferably be in the range from 10 to 80 %, based on the total weight of the cosmetic product for hair conditioning. In case

the cosmetic product for hair conditioning is a hair wash, a content of 20 % by weight or less may be favorable.

The cosmetic products for hair conditioning according to the present invention may further contain, within the range in proportional and qualitative sense not obstructing the effects of the present invention and in accordance with each specific purpose, other ingredients in addition to the constituent components given above. For example, there may be recited oily ingredients, such as liquid paraffin, squalane, lanolin derivatives, higher alcohols, various ester oils, avocado oil, palm oil, beef tallow, jojoba oil, silicone oils, polyalkylene glycol polyethers and carboxylic acid oligoesters thereof and hydrocarbons based on terpene; water-soluble polyhydric alcohols, such as ethylene glycol, propylene glycol, 1,3-butylene glycol, glycerol, sorbitol and polyethylene glycol; moisture-preserving agents, such as hyaluronic acid, chondroitin sulfuric acid and pyrrolidone carboxylate; UV absorbers; UV scattering agents; resins, such as resins based on acrylate, silicone resins and polyvinylpyrrolidone; proteins and protein degradation products, such as soybean proteins, gelatine, collagen, silk fibroin and elastin; antiseptics, such as ethylparaben and butylparaben; activating agents, such as various amino acids, biotin and pantothenic acid derivatives; blood flow promoters, such as  $\gamma$ -oryzanol, sodium dextran sulfate, vitamin E derivatives and nicotinic acid derivatives; antiseborrheic agents, such

as sulfur and thiantol; diluents, such as ethanol, isopropanol and tetrachlorodifluoroethane; thickning agents, such as carboxyvinyl polymers; others including medicaments, perfumes and colorants.

⑤ Cosmetic products for manicure

The cosmetic materials according to the present invention are in particular superior also for use as cosmetic material for manicure. In case the cosmetic materials according to the present invention is used as the cosmetic material for manicure, a cosmetic product for manicure containing the polysaccharide-sterol derivative can be obtained by preparation by admixing the polysaccharide-sterol derivative in a pertinent manner to, or incorporating it, as an alternative component, in a mixture of components known usually for a cosmetic product for manicure.

For the polysaccharide-sterol derivative to be used for the cosmetic product for manicure, any one can be employed so long as it is a polysaccharide-sterol derivative, wherein those having a weight-average molecular weight in the range from 10,000 to 1,000,000, preferable from 30,000 to 500,000 may favorably be used, since they improve aspects for peeling off, for the smooth appearance and for the luster. The content of the polysaccharide-sterol derivative in the cosmetic product for manicure may favorably be in the range from 0.001 to 50 %, preferably from 0.01 to 30 % by weight, based on the total weight of the cosmetic product. For maintaining the water-retentivity and the coating film-forming ability in an adaptable condition, the

content of the polysaccharide-sterol derivative should favorably be in the range from 0.001 to 50 % by weight.

The polysaccharide-sterol derivative to be used for the cosmetic product for manicure may be incorporated after having been dissolved in a solvent system used usually in manicure liquid. Such a solvent system is constituted essentially of a mixture of various volatile organic solvents for reducing the drying time relatively short. While such solvents may adequately be chosen among volatile organic solvents known usually, preference is given to acetone, ethyl acetate, butyl acetate, 2-methoxyethyl acetate, methyl ethyl ketone, methyl isobutyl ketone, methyl acetate, amyl acetate and isopropyl acetate. For the solvent system, that containing a diluent is preferred. As the diluent, saturated linear and branched chain hydrocarbons, such as hexane and octane; and aromatic hydrocarbons, such as toluene and xylene, may be exemplified. The solvent system may comprise other volatile solvents. There is no special limitation for the volatile solvent, it may comprise, for example, ethanol, n-butanol, n-propanol, isopropanol and mixture of them.

In the cosmetic product for manicure, a coating film-forming material may also be incorporated. While the polysaccharide-sterol derivative has in itself a coating film-forming ability, it is no matter that another coating film-forming material known usually is further incorporated. As the coating film-forming material, there may be recited, for example,

nitrocellulose products, in particular, of "RS" and "SS" types. As the additionally incorporated coating film-forming material, polyvinyl derivatives, such as polyvinyl butyrate etc., may also be employed.

In the cosmetic product for manicure, a plasticizer may also be incorporated. The content of the plasticizer may favorably be in the range from 2 to 10 %, based on the total weight of the cosmetic product. For the plasticizer, any one may be incorporated, so long as it permit adjustment of the flexibility of the coating film without reducing the physical strength of the coating film. As the plasticizer incorporated favorably in the cosmetic product for manicure according to the present invention, there may be recited, for example, tricresyl phosphate, benzyl benzoate, tributyl phosphate, butyl acetylricinoleate, glyceryl acetylricinoleate, dibutyl phthalate, butyl glycolate, dioctyl phthalate, butyl stearate, tributoxyethyl phosphate, triphenyl phosphate, triethyl citrate, tributyl citrate, tributyl acetylcitrate, tri(2-ethylhexyl) acetylcitrate, dibutyl tartarate, dimethoxyethyl phthalate, diisobutyl phthalate, diamyl phthalate, camphor, glycerol triacetate and mixtures of them.

In the cosmetic product for manicure according to the present invention, such resins as used in general in cosmetic products for manicure may be incorporated. Any resin may be incorporated for the resin to be used, so long as it is suitable, wherein arylsulfonamide-formaldehyde resins and alkyd resins

may be exemplified. The content of the resin may favorably be in the range from 0.5 to 15 %, based on the total weight of the cosmetic product for manicure. As the resin of arylsulfonamide-formaldehyde type, well known toluenesulfonamide-formaldehyde resin may be enumerated. Such resins improve the luster and adhesion, while at the same time increasing the coating film-forming performance.

The cosmetic product for manicure according to the present invention may either be transparent or be colored. For coloration, one or more kinds of natural or synthetic pigments known per se may be incorporated. As the pigment, any one may be employed, so long as it is a pigment known usually for cosmetic product. As the organic pigment, for example, D&C Red 5, D&C Red 6, D&C Red 7, D&C Red 10, D&C Red 11, D&C Red 12, D&C Red 13 and D&C Red 34; and lake pigments, such as Lake D&C yellow 5 and Lake D&C Red 2. As other organic pigment, guanine and others may also be recited. As the inorganic pigment, for example, titanium dioxide, bismuth oxychloride, brown iron oxide and red iron oxide may be recited. The content of the pigment is determined according to each specific purpose of the cosmetic product for manicure in an adequate manner, while it may favorably be in the range from 0.01 to 2 %, based on the total weight of the cosmetic product.

In the cosmetic product for manicure according to the present invention may further be incorporated a thixotroping agent in some content in order to avoid sedimentation of pigment. For the thixotroping agent,

any known one may be incorporated within the range not obstructing the purpose of the present invention, so long as it is adequate, wherein the content thereof may adequately be chosen. The cosmetic product for manicure according to the present invention may contain further additives used ususally in manicure liquid. For such additive, any known ones chosen in accordance with each specific purpose may be employed and contained, so long as they are those contained in conventional cosmetic products. As examples of the additives, there may favorably be recited, for example, UV absorbers, such as benzophenone derivatives and ethyl 2-cyano-3,3-diphenylacrylate, and so on.

For the cosmetic product for manicure according to the present invention, any ones having configurations known from the past for cosmetic products for manicure may be used without any special respect to the form of the cosmetic product.

While the cosmetic products according to the present invention are detailed above with respect to the general description of cosmetics, make-up cosmetics, cosmetic products for lip rouge, cosmetic products for hair conditioning and cosmetic products for manicure, the cosmetic products according to the present invention are not specifically restricted thereto. The polysaccharide-sterol derivative may be incorporated in cosmetic products of any morphological state by compounding in adequate manner. Any kind of cosmetic product can be converted into a cosmetic product exhibiting a characteristic feature not

revealed heretofore, by making use of the characteristic feature of the polysaccharide-sterol derivative sufficiently.

The polysaccharide-sterol derivative reveals a feature that it gives birth to a product exhibiting a superior ability of forming a coating film when the proportion of introduction of the sterol groups into the polysaccharide-sterol derivative is in the range from 0.01 to 20 groups per 100 monosaccharide units constituting the polysaccharide, in which the stiffness of the coating film may occasionally be made flexibler by the introduction of the steryl group or by having resort to the polysaccharide used. When the proportion of introduction of the steryl group exceeds over 20 groups per 100 monosaccharide units, the dissolving performance at room temperature becomes deteriorated.

While the content of the polysaccharide-sterol derivative in the cosmetic product may be different for each specific form of the product, it may in general favorably be in the range from 0.001 to 50 % by weight, preferably from 0.001 to 30 % by weight. When the content of the polysaccharide-sterol derivative is too low, the effect of the present invention will not be obtained, whereas when the content is too high, there may result in occurrence of an adherent touch or a heavy feel of application.

The coating film formed from the polysaccharide-sterol derivative reveals no adherent touch feel and brings about a smooth touch when the cosmetic product has a content of the polysaccharide-sterol derivative



of 50 % by weight or less. By utilizing these characteristic features with adequate contrivance in accordance with each specific form of known cosmetic product, it is possible to use the polysaccharide-sterol derivative according to the present invention in every cosmetic product according to the present invention in a favorite manner.

Below, the present invention will further be described in more detail by way of SYNTHESIS EXAMPLES, EXAMPLES and COMPARATIVE EXAMPLES.

#### SYNTHESIS EXAMPLE 1

##### Synthesis of N-(6-isocyanatohexyl)cholesteryl carbamate

In an eggplant type flask of 1 liter capacity, there were charged 25 grams (0.065 mole) of cholesterol and thereto were added 300 ml of toluene to dissolve it, whereto 17 ml (0.12 mole) of triethylamine were added. Thereto were added 161 grams (0.96 mole) of hexamethylene diisocyanate dissolved in 300 ml of toluene to cause reaction at a temperature of 80 °C for about 6 hours under a nitrogen atmosphere. After termination of the reaction, toluene and the excess of hexamethylene diisocyanate were removed under a reduced pressure. By standing the resulting yellow oily residue at room temperature overnight, pale yellow crystals were formed. The crystals were taken out and thereto was added about 1 liter of hexane, whereupon the mixture was shaken vigorously and, then, the supernatant liquid was removed by decantation. These

washing procedures were repeated four times, whereupon the crystals were dried at room temperature for three hours under a reduced pressure, whereby a white solid matter was obtained. A yield amount of 18.25 grams with a yield of 50.9 % was recorded. The observed results of IR are recited below:

IR (KBr,  $\text{cm}^{-1}$ ): 3260, 2320, 1680, 1130

From the above, it was confirmed that N-(6-isocyanatohexyl)cholesterylcarbamate was obtained.

#### SYNTHESIS EXAMPLE 2

Synthesis of pullulan-cholesterol derivative  
(abbreviated hereinafter as CHP 0.9) in which  
0.9 cholesteryl group was introduced per 100  
monosaccharide units in pullulan

In an eggplant type flask of 1 liter capacity, there were charged 40 grams of pullulan (weight-average molecular weight 108,000) and 420 ml of dimethyl sulfoxide and the mixture was agitated at 80 °C under a nitrogen atmosphere to cause dissolution. Thereto were added 1.78 grams (3.21 millimoles) of N-(6-isocyanatohexyl)cholesterylcarbamate synthesized in Synthesis Example 1 dissolved in 32.4 ml (0.40 mole) of pyridine to cause reaction at 90 °C for 1.5 hours. After termination of the reaction, dimethyl sulfoxide was removed under a reduced pressure, whereupon the resulting oily residue was poured into 6 liters of acetone to cause precipitation.

After removal of the supernatant, 4 liters of acetone were added to the resulting precipitate and the mixture was stood still at room temperature overnight.

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The precipitate was collected by filtration and was then dried under a reduced pressure. The resulting solid matter was dissolved in dimethyl sulfoxide and the solution was charged in a dialysis membrane (a product of the firm Spectropore with trademark SPECTRA/POR 3; a fractionating molecular weight of 3,500) and was dialyzed against distilled water for one week. 1.5 liters of the resulting polymer solution were subjected to freeze-drying by a conventional procedure, whereby a white solid matter was obtained. The product amounted to 31.7 grams (yield = 76.2 %). The observation results of  $^1\text{H-NMR}$  ( $\delta$  ppm) and of IR are recited below:

$^1\text{H-NMR}$  ( $\delta$  ppm) ( $\text{DMSO-d}_6/\text{D}_2\text{O} = 20/1$ , vol. TMS):

0.68-2.40, 2.60-4.60, 4.60-5.05

IR (KBr,  $\text{cm}^{-1}$ ): 1680, 1180-900

From integration of the  $^1\text{H-NMR}$  spectrum, the surface area for the peak due to cholesteryl group ( $\delta = 0.6 - 2.3$ ) and that due to pullulan ( $\delta = 4.7 - 5.1$ ) were determined, in order to calculate the degree of substitution with cholesteryl group with respect to 100 monosaccharide units. As a result, it was found that the degree of substitution with cholesteryl group per 100 monosaccharide units was 0.9 group. The weight-average molecular weight thereof was determined to be 109,700. From these data, it was confirmed that the compound obtained was CHP 0.9.

### SYNTHESIS EXAMPLE 3

Synthesis of pullulan-cholesterol derivative

(abbreviated hereinafter as CHP 0.1) in which

0.1 cholesteryl group was introduced per 100  
monosaccharide units in pullulan

By the same reaction operation as in Synthesis Example 2 with the only exception that the charged amount of N-(6-isocyanatohexyl)cholesterylcarbamate was changed to 0.198 gram (0.357 millimole), CHP 0.1 was synthesized. From integration of the <sup>1</sup>H-NMR spectrum, the surface area for the peak due to cholesteryl group and that due to pullulan were determined, in order to calculate the degree of substitution by cholesteryl group with respect to 100 monosaccharide units. As a result, it was found that the degree of substitution by cholesteryl group per 100 monosaccharide units was 0.1 group. The weight-average molecular weight thereof was determined to be 108,200.

SYNTHESIS EXAMPLE 4

Synthesis of pullulan-cholesterol derivative  
(abbreviated hereinafter as CHP 0.05) in which  
0.05 cholesteryl group was introduced per 100  
monosaccharide units in pullulan

By the same reaction operation as in Synthesis Example 2 with the only exception that the charged amount of N-(6-isocyanatohexyl)cholesterylcarbamate was changed to 0.099 gram (0.178 millimole), CHP 0.05 was synthesized. From integration of the <sup>1</sup>H-NMR spectrum, the surface area for the peak due to cholesteryl group and that due to pullulan were determined, in order to calculate the degree of substitution by cholesteryl group with respect to 100 monosaccharide units. As a result, it was found that the degree of substitution

by cholesteryl group per 100 monosaccharide units was 0.05 group. The weight-average molecular weight thereof was determined to be 108,100.

#### SYNTHESIS EXAMPLE 5

Synthesis of pullulan-cholesterol derivative  
(abbreviated hereinafter as CHP 10) in which  
10 cholesteryl groups were introduced per 100  
monosaccharide units in pullulan

By the same reaction operation as in Synthesis Example 2 with the only exception that the charged amount of N-(6-isocyanatohexyl)cholesterylcarbamate was changed to 29.7 grams (53.6 millimoles), CHP 10 was synthesized. From integration of the <sup>1</sup>H-NMR spectrum, the surface area for the peak due to cholesteryl group and that due to pullulan were determined, in order to calculate the degree of substitution by cholesteryl group with respect to 100 monosaccharide units. As a result, it was found that the degree of substitution by cholesteryl group per 100 monosaccharide units was 10 groups. The weight-average molecular weight thereof was determined to be 127,400.

#### SYNTHESIS EXAMPLE 6

Synthesis of pullulan-cholesterol derivative  
(abbreviated hereinafter as CHP 15) in which  
15 cholesteryl groups were introduced per 100  
monosaccharide units in pullulan

By the same reaction operation as in Synthesis Example 2 with the only exception that the charged amount of N-(6-isocyanatohexyl)cholesterylcarbamate was changed to 49.5 grams (89.3 millimoles), CHP 15 was

synthesized. From integration of the  $^1\text{H}$ -NMR spectrum, the surface area for the peak due to cholesteryl group and that due to pullulan were determined, in order to calculate the degree of substitution by cholesteryl group with respect to 100 monosaccharide units. As a result, it was found that the degree of substitution by cholesteryl group per 100 monosaccharide units was 15 groups. The weight-average molecular weight thereof was determined to be 137,000.

#### SYNTHESIS EXAMPLE 7

Synthesis of mannan-cholesterol derivative  
(abbreviated hereinafter as CHM) in which 0.9  
cholesteryl group was introduced per 100  
monosaccharide units in mannan

By the same reaction operation as in Synthesis Example 2 with the exception that 26.2 g of mannan (of a weight-average molecular weight of 85,000) were used instead of pullulan and the charged amounts of N-(6-isocyanatohexyl)cholesterylcabamate, of pyridine and of dimethyl sulfoxide were changed to 1.08 grams (1.95 millimoles), 19.6 ml and 320 ml, respectively, 21.5 grams of mannan-cholesterol derivative were synthesized. From observations of  $^1\text{H}$ -NMR and IR, it was confirmed that the resulting compound was a mannan-cholesterol derivative (CHM). From integration of the  $^1\text{H}$ -NMR spectrum, the surface area for the peak due to cholesteryl group and that due to mannan were determined, in order to calculate the degree of substitution by cholesteryl group with respect to 100 monosaccharide units. As a result, it was found that

the degree of substitution by cholesteryl group per 100 monosaccharide units was 0.1 group. The weight-average molecular weight thereof was determined to be 85,200.

#### EXAMPLE 1

##### Preparation of an O/W type milky lotion containing CHP 0.9 and assessment test

Using CHP 0.9 obtained in Synthesis Example 2, an O/W type milky lotion was prepared. For the preparation of the O/W type milky lotion, the components 1 to 10 given below are blended in the proportion as given so that the total amount will sum up to 100 grams. First, components 1 to 3 were blended at 70 °C to cause them to dissolve. After dissolution, the components 4 to 10 were added thereto to cause them to be dispersed. The resulting dispersion was then degassed before being bottled in a predetermined vessel, whereby 100 grams of an O/W type milky lotion containing CHP 0.9 were obtained.

The components used are as given below, wherein the blending proportion is on the weight basis.

1. Stearic acid	1
2. Beeswax	2
3. Microcrystalline wax	1
4. CHP 0.9 (Synth. Example 2)	0.3
5. Propylene glycol	5
6. Glycerin	5
7. Ethyl alcohol	2
8. Paraoxybenzoic acid ester	0.3
9. Perfume	0.3
10. Pure water	remainder

Then, assessment tests consisting of a transcription test, a test for the effect of improving artificial rough skin, a test for practical use and a test for sunburn prevention were carried out for assessing the performance of the resulting O/W type milky lotion containing CHP 0.9.

[Transcription Test]

Two filter papers were provided for, of which one was impregnated with water and the other one was impregnated with squalene. A colorless nylon plate coated with an adequate amount of the CHP 0.9-containing O/W type milky lotion and dried was pressed onto the filter paper impregnated with squalene with ten repeats of up-and-down motions. Also for the filter paper impregnated with water similar operations were performed with repeats of up-and-down motion. After the repetitions of up-and-down motion, the color deepness of the filter paper due to color transference from the nylon plate was visually assessed by one and the same observer. The assessment was realized in a judgement criterion, in which the case where no transcription was recognized scores one point, the case where a scarce transcription was recognized scores two points and the case where transcription was marked scores three points. The assessment test was carried out in five repeats using in each case newly prepared filter papers with impregnation with water and with squalene. The visual assessment of the transcribed color by five repetitions was performed by one and the same person. Each assessment score is given by average



of five assessments on the filter papers impregnated with water and with squalene. The results are recited in Table 1.

Table 1. Transcription test for O/W type milky lotion

	Average score
Example 1	1.6
2	1.8
3	2.0
4	1.6
5	1.8
6	1.6
Comp. Example 1	2.4
2	2.6
3	3.0
4	2.6

[Test for the Effect of Improving Artificial Rough Skin]

《 Method of Experiment 》

For ten women of ages of 20 - 42, amount of water retained in the horny cell layer, amount of transcutaneous water evaporation and occurrence of efflorescence were observed for assessing the effect of improvement in an artificial rough skin.

First, the skin on the inside of arm was examined by tightly fitting a glass cup having a diameter of 3 cm onto the skin and the cup was charged with 10 ml of 5 % solution of sodium dodecyl sulfate

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(SDS) while holding the cup fitted on the skin with slight swinging of the solution for 10 minutes, before the solution was collected. Then, on the same skin, a forced rough skin was caused by tightly fitting the cup having a diameter of 3 cm in a similar way onto the skin and the cup was charged with 10 ml of 5 % solution of sodium dodecyl sulfate (SDS) while holding the cup fitted onto the skin with slight swinging of the solution for 20 minutes, before the solution was collected. After one day from the above SDS treatment, each 5 ml of the CHP 0.9-containing O/W type milky lotion were applied onto the treated skin twice a day. The amount of water retained in the horny cell layer was determined in the manner as follows:

(1) Determination of amount of water retained in the horny cell layer

The amount of water retained in the horny cell layer was determined according to the method for moisture-loaded test for the horny cell layer water proposed by Ueda et al (Flafragrance Journal, Extraneous Eddition on 1994 No. 13; "Method for determining moisture-preserving effect of skin") using a high-frequency skin water detector (MODEL SKICON-200, trademark, of the firm IBS).

Determinations were carried out at occasions before the SDS treatment, three days after the SDS treatment, seven days after the SDS treatment and 14 days after the SDS treatment. On the determination, the skin at the site to be examined was washed with a warm water of 37 °C for 30 seconds and five

determinations were performed for each person at 20 °C under a relative humidity of 50 %, whereupon average of the determined values was calculated by summing up all the determined values and dividing the sum with the number of persons examined. The average of the whole values was taken at occasions before the SDS treatment, three days after the SDS treatment, seven days after the SDS treatment and 14 days after the SDS treatment. By dividing the average of the whole after each SDS treatment by the average value of the whole before the SDS treatment, the relative values were calculated. The relative values are recited in Table 2. The higher the relative vales are, the greater the amount of water retained in the horny cell layer and, also, the more superior the coated O/W type milky lotion will be.

Table 2. Test for improving artificial rough skin  
by O/W type milky lotion

	Water retained in horny layer			Transcutaneous water evaporat.			Assess- ment (score)
	Days after the treatment						
	3	7	14	3	7	14	
<u>Example</u>							
1	1.87	1.99	2.03	0.87	0.84	0.79	0.4
2	1.97	2.09	2.09	0.77	0.84	0.75	0.3
3	2.17	2.00	1.99	0.88	0.89	0.79	0.3
4	2.11	1.80	2.20	0.81	0.81	0.77	0.2
5	1.99	1.95	2.15	0.80	0.81	0.78	0.2
6	1.87	1.89	1.87	0.89	0.85	0.79	1.2
<u>Comp. Example</u>							
1	1.11	1.00	1.04	0.96	0.94	0.97	2.1
2	1.07	1.00	1.04	0.97	0.94	0.99	0.4
3	0.87	1.09	1.00	0.96	0.94	0.98	0.2
4	1.07	0.89	1.03	0.97	0.95	0.99	2.2

Then, the transcutaneous evaporation was determined in the following manner.

(2) Determination of transcutaneous evaporation

The transcutaneous evaporation of water from the horny cell layer was determined using a transcutaneous evaporation detector (Model TEWAMETER-TM 200, trademark, supplied from the firm C + K).

Determinations were carried out at occasions before the SDS treatment, three days after the SDS treatment, seven days after the SDS treatment and 14 days after the SDS treatment. On the determination,

five determinations were performed for each person directly after the determination of amount of water retained in the horny cell layer of the above (1) and the average values of the determined values for each person were calculated for each person. By summing up all the determined values and dividing the sum with the number of persons examined the average of the whole values was calculated. The average of the whole values was taken at occasions before the SDS treatment, three days after the SDS treatment, seven days after the SDS treatment and 14 days after the SDS treatment. By dividing the average of the whole after each SDS treatment by the average value of the whole before the SDS treatment, the relative values were calculated. The relative values are recited in Table 2. The lower the relative vales are, the greater the amount of water retained in the horny cell layer and, also, the more superior the coated O/W type milky lotion will be.

Then, occurrence of efflorescence was assessed for 10 persons to be examined who have received a coating layer of the CHP 0.9-containing O/W type milky lotion in the above experiments (1) and (2), after all the above experiments have been finished, in accordance with the judgement criterium given below:

(3) Assessment of efflorescence

The assessment of occurrence of efflorescence was carried out for each person isolately in the attendance of a dermatologist in accordance with the assessment criterium given below:

0 : No dry skin desquamation is recognized.

- 1 : Slight dry skin desquamation is recognized (slight desquamation or luster).
- 2 : Clear desquamation of dry skin is recognized with clear discrimination of the border of treated area, clear recognition of exfoliated skin with partial luster and cracks.
- 3 : Remarkable desquamation of dry skin pieces with clear desquamated dry skin with clear luster and cracks.

Under the assessment critirium given above, ten persons were examined and the results are represented by average value in Table 2. The smaller the numeral values of assessment, the lower the damaging effect on the skin and, thus, more superior the O/W type milk lotion tested will be.

[Practical Application Test]

《Method of experiment》

Twenty Japanese women patients of ages of 27 - 42 suffering habitually from rough skin and dry skin were treated by applying the CHP 0.9-containing O/W type milky lotion over a test priod of one month. By oral hearing from each patient, "wet feel", "improvement in stretched skin" and "feel of lubrication" were assessed, in order to examine the beauty skin effect, such as wet feel (water-retentive effect) and improved skin stretching (activating effect) after the one month test as well as the touch feel (feel of lubrication) during the practical application. Number of patients who gave affirmative reply are recited in Table 3.

Table 3. Practical Application Test with O/W Type Milky Lotion

	Affirmative patients among 20			Sunburn prevention
	Wet feel	Improved stretch	Lubricat. feel	
<u>Example</u>				
1	18	15	18	19.0
2	17	16	18	14.5
3	18	17	18	12.2
4	19	14	17	19.4
5	17	16	15	20.0
6	13	15	13	19.6
<u>Comp.</u>				
<u>Example</u>				
1	14	11	9	10.5
2	11	10	10	8.6
3	7	9	7	2.9
4	8	11	8	5.1

[Test for Sunburn Protection]

《 Method of Experiments 》

The sunburn protection test was performed by SPF (Sun Protection Factor) determination by animals to assess the sunburn protection effect. Marmots were prepared for the test by depilating back fur using a depilating cream. On this depilated area was coated with the CHP 0.9-containing O/W type milky lotion at a dose of  $2 \mu\text{l}/\text{cm}^2$ . After 15 minutes, the coated area was irradiated by an ultraviolet ray for a definite interval using an ultraviolet lamp (of Toshiba Corp. with trademark of FL-SE). After 24 hours from the

irradiation, erythema was examined on the coated area and on the area without coating, wherefrom the least necessary dose of ultraviolet ray for causing a slight erythema was determined. From the calculated least necessary dose of ultraviolet ray, SPF was calculated. SPF is calculated by dividing the least necessary dose of ultraviolet ray on the coated area by the least necessary dose of ultraviolet ray on the non-coated area. Results for the SPF are recited in Table 3. From the results of the sunburn protection test, it was confirmed that the CHP 0.9-containing O/W type milky lotion was superior in the sunburn protecting effect.

From the above assessment tests, it was proven that the CHP 0.9-containing O/W type milky lotion has marked effects for increasing the water-retentivity in the horny layer (recovery of water retentive function), for decreasing the transcutaneous water evaporation (increase in the moisture barriering function) and for preventing dry efflorescence and is superior not only in the beauty skin effect, such as water-retentivity and activating effect, but also in the sunburn protecting effect, together with superior lubricating feel.

#### EXAMPLE 2

##### Preparation of CHP 0.1-containing O/W type milky lotion and assessment test

With the same blending proportion and by the same preparation procedures as in Example 1 except that the CHP 0.1 obtained in Synthesis Example 3 was used instead of the CHP 0.9, an O/W type milky lotion was



prepared. All the assessment tests were also carried out in the same manner as in Example 1. Results are recited in Tables 1 to 3.

#### EXAMPLE 3

##### Preparation of CHP 0.05-containing O/W type milky lotion and assessment test

With the same blending proportion and by the same preparation procedures as in Example 1, except that the CHP 0.05 obtained in Synthesis Example 4 was used instead of the CHP 0.9, an O/W type milky lotion was prepared. All the assessment tests were also carried out in the same manner as in Example 1. Results are recited in Tables 1 to 3.

#### EXAMPLE 4

##### Preparation of CHP 10-containing O/W type milky lotion and assessment test

With the same blending proportion and by the same preparation procedures as in Example 1, except that the CHP 10 obtained in Synthesis Example 5 was used instead of the CHP 0.9, an O/W type milky lotion was prepared. All the assessment tests were also carried out in the same manner as in Example 1. Results are recited in Tables 1 to 3.

#### EXAMPLE 5

##### Preparation of CHP 15-containing O/W type milky lotion and assessment test

With the same blending proportion and by the same preparation procedures as in Example 1, except that the CHP 15 obtained in Synthesis Example 6 was used instead of the CHP 0.9, an O/W type milky lotion was

prepared. All the assessment tests were also carried out in the same manner as in Example 1. Results are recited in Tables 1 to 3.

#### EXAMPLE 6

##### Preparation of CHM-containing O/W type milky lotion and assessment test

With the same blending proportion and by the same preparation procedures as in Example 1, except that the CHM obtained in Synthesis Example 7 was used instead of the CHP 0.9, an O/W type milky lotion was prepared. All the assessment tests were also carried out in the same manner as in Example 1. Results are recited in Tables 1 to 3.

#### SYNTHESIS EXAMPLE 8

##### Synthesis of pullulan-tristrimethylsiloxysilyl- propylcarbamate (abbreviated hereinafter as TSP) in which 1.7 tristrimethylsiloxysilylpropyl groups were introduced per 100 monosaccharide units in pullulan

Ten grams of a pullulan (having a weight-average molecular weight of 108,000) were dissolved in 300 ml of N-methylpyrrolidone, whereto 0.01 gram of triethylamine was added as the catalyst and thereto was dropped 0.7 gram of tristrimethylsiloxysilylpropyl isocyanate to cause reaction at 100 °C for 2 hours. The reaction mixture was poured into acetone, whereupon the precipitate formed was washed with methanol and was dried. 50 grams of pullulan tristrimethylsiloxysilylpropylcarbamate were obtained. When the degree of substitution by the tristrimethylsiloxysilylpropyl

groups per 100 monosaccharide units in the pullulan was calculated from the elementary analysis data, a value of 1.7 groups was obtained. The weight-average molecular weight was found to be 111,000.

#### COMPARATIVE EXAMPLE 1

##### Preparation of TSP 5-containing O/W type milky lotion and assessment test

With the same blending proportion and by the same preparation procedures as in Example 1, except that the TSP obtained in Synthesis Example 8 was used instead of the CHP 0.9, an O/W type milky lotion was prepared. All the assessment tests were also carried out in the same manner as in Example 1. Results are recited in Tables 1 to 3.

#### COMPARATIVE EXAMPLE 2

##### Preparation of pullulan-containing O/W type milky lotion and assessment test

With the same blending proportion and by the same preparation procedures as in Example 1, except that a commercial pullulan (weight-average molecular weight of 108,000) was used instead of the CHP 0.9, an O/W type milky lotion was prepared. All the assessment tests were also carried out in the same manner as in Example 1. Results are recited in Tables 1 to 3.

#### COMPARATIVE EXAMPLE 3

##### Preparation of CHP-not-containing O/W type milky lotion and assessment test

With the same blending proportion and by the same preparation procedures as in Example 1, except that the CHP 0.9 was not incorporated, an O/W type milky

lotion was prepared. All the assessment tests were also carried out in the same manner as in Example 1. Results are recited in Tables 1 to 3.

#### COMPARATIVE EXAMPLE 4

##### Preparation of polyvinyl alcohol-containing O/W type milky lotion and assessment test

With the same blending proportion and by the same preparation procedures as in Example 1, except that a commercial polyvinyl alcohol (a product of Kuraray Co., Ltd. with trademark of KURARE POVAL PVA-224C) was used instead of the CHP 0.9, an O/W type milky lotion was prepared. All the assessment tests were also carried out in the same manner as in Example 1. Results are recited in Tables 1 to 3.

#### EXAMPLE 7

##### Preparation of 0.001 % CHP-containing O/W type milky lotion and assessment test

With the same blending proportion and by the same preparation procedures as in Example 1, except that the blended porportion of CHP 0.9 was changed from 0.3 % by weight to 0.001 % by weight, an O/W type milky lotion was prepared. For the assessment test, only transcription test was carried out and other tests were omitted. Result is recited in Table 4.

Table 4. Transcription test of O/W milky lotion

	Assessment of transcription (score)
Example	
7	2.6
8	2.2
9	1.0
10	1.2

EXAMPLE 8

Preparation of 0.01 wt. % CHP-containing O/W  
milky lotion and assessment test

With the same blending proportion and by the same preparation procedures as in Example 1, except that the blended proportion of CHP 0.9 was changed from 0.3 % by weight to 0.01 % by weight, an O/W type milky lotion was prepared. For the assessment test, only transcription test was carried out and other tests were omitted. Result is recited in Table 4.

EXAMPLE 9

Preparation of 50 wt. % CHP-containing O/W  
milky lotion and assessment test

With the same blending proportion and by the same preparation procedures as in Example 1, except that the blended proportion of CHP 0.9 was changed from 0.3 % by weight to 50 % by weight, an O/W type milky lotion was prepared. For the assessment test, only the transcription test was carried out and other tests were omitted. Result is recited in Table 4.

#### EXAMPLE 10

##### Preparation of 20 wt. % CHP-containing O/W milky lotion and assessment test

With the same blending proportion and by the same preparation procedures as in Example 1, except that the blended porportion of CHP 0.9 was changed from 0.3 % by weight to 20 % by weight, an O/W type milky lotion was prepared. For the assessment test, only transcription test was carried out and other tests were omitted. Result is recited in Table 4.

#### EXAMPLE 11

##### Preparation of CHP 0.9-containing beauty wash

A beauty wash was prepared using the CHP 0.9 obtained in Synthesis Example 2. For preparing the beauty wash, the blending components 1 to 8 given below are compounded in the proportion as given, so that the total amount will sum up to 100 grams. First, the components 1 to 4 were mixed at room temperature to attain dissolution. On the other hand, the components 5 to 8 were mixed at room temperature to form a dissolved mixture. To this dissolved mixture, the above-obtained dissolved components 1 to 4 were admixed and agitated to attain dispersion. In this manner, 100 grams of CHP 0.9-containing slightly turbid beauty wash were obtained.

Components blended are recited below with each blending proportion in weight parts:

- |    |                                  |      |
|----|----------------------------------|------|
| 1. | : CHP 0.9 of Synthesis Example 2 | 0.25 |
| 2. | : Glycerin                       | 1.5  |
| 3. | : Ethanol                        | 6    |

4.	: Propylene glycol	1.5
5.	: Citric acid	0.01
6.	: Sodium citrate	0.1
7.	: Perfume	0.05
8.	: Pure water	remainder

#### EXAMPLE 12

##### Preparation of CHP 0.9-containing cream

A cream was prepared using the CHP 0.9 obtained in Synthesis Example 2. For preparing the cream, the blending components 1 to 9 given below are compounded in the proportion as given, so that the total amount will sum up to 100 grams. First, the components 1 to 3 were mixed at 70 °C to attain dissolution. On the other hand, the components 4 to 9 were mixed and were dissolved at 70 °C. To the dissolved mixture of components 1 to 3, the solution of the components 4 to 9 was added and agitated. The mixture was then cooled to 25 °C and was stood still, whereby 100 grams of CHP 0.9-containing white cream were obtained.

Components blended are recited below with each blending proportion in weight parts:

1.	: Squalane	5
2.	: 2-ethylhexanoic acid triglyceride	1
3.	: Vaseline	0.5
4.	: CHP 0.9 (Synthesis Example 2)	1.5
5.	: Glycerin	3
6.	: 1,3-butanediol	4
7.	: Polyglycerolpolyoxybutylene stearyl ether	2.5

8.	Perfume	0.2
9.	Pure water	remainder

### EXAMPLE 13

#### Preparation of CHP 0.9-containing hair cream

A hair cream was prepared using the CHP 0.9 obtained in Synthesis Example 2. For preparing the hair cream, the blending components 1 to 15 given below are compounded in the proportion as given, so that the total amount will sum up to 100 grams. First, the components 1 to 8 were mixed and dissolved at 70 °C. On the other hand, the components 9 to 15 were mixed and were dissolved at 70 °C. The solution of the components 1 to 8 was added to the solution of the components 9 to 15 and agitated. The mixture was then cooled to 25 °C and was stood still, whereby 100 grams of CHP 0.9-containing white hair cream were obtained.

Components blended are recited below with each blending proportion in weight parts:

1.	: Squalane	30.0
2.	: Vaseline	3.0
3.	: Bees wax	4.0
4.	: Stearic acid	4.0
5.	: Olive oil	2.0
6.	: Sorbitan monostearate	2.5
7.	: Polyoxyethylenesorbitan mono- stearate	2.5
8.	: Butylparaben	0.1
9.	: CHP 0.9 (Synthesis Example 2)	3
10.	: 1,3-butanediol	2.5
11.	: Polyethylene glycol 200	1.5



12.	: Triethanolamine	1.0
13.	: Paraoxybenzoic acid ester	0.1
14.	: Perfume	0.2
15.	: Pure water	remainder

#### EXAMPLE 14

##### Preparation of CHP 0.9-containing hair lotion

A hair lotion was prepared using the CHP 0.9 obtained in Synthesis Example 2. For preparing the hair lotion, the blending components 1 to 7 given below are compounded in the proportion as given, so that the total amount will sum up to 100 grams. First, the components 1 to 6 were mixed at room temperature to attain dissolution. This solution was admixed to the pure water of component 7 with agitation. In this manner, 100 grams of CHP 0.9-containing slightly turbid liquid hair lotion were obtained.

Components blended are recited below with each blending proportion in weight parts:

1.	: CHP 0.9 (Synthesis Example 2)	0.1
2.	: Ethanol	10
3.	: Glycerin	3
4.	: Carboxymethylchitin	0.01
5.	: Vitamin E	0.1
6.	: Dyestuff	0.02
7.	: Pure water	remainder

For this CHP 0.9-containing hair lotion, the following test was carried out, in order to examine its hair protecting effect.

[Test for Assessing Hair Protecting Effect]

《Method of Experiment》

Ten grams of hair of a Japanese woman who has never experienced any permanent waving or bleaching treatment were collected as a bundle (of a length of 10 cm) for use as hair sample. Onto this bundle, 3 ml of the CHP 0,9-containing hair lotion were coated and dried in air to subject it to an organoleptic assessment. The organoleptic assessment was performed by five professional panelists of this firm according to the assessment criterion given below to assess smoothness, luster and wet feel (moisture-retentivity) of the hair sample. Average scored points for them are recited in Table 5.

《Assessment Criterion》

〈Smoothness〉

Score	1	2	3	4	5
Asses- sment	Inferior	Somewhat inferior	Ordinary	Somewhat superior	Superior

〈Luster〉

Score	1	2	3	4	5
Asses- sment	Inferior	Somewhat inferior	Ordinary	Somewhat superior	Superior

〈Wet Feel〉

Score	1	2	3	4	5
Asses- sment	Inferior	Somewhat inferior	Ordinary	Somewhat superior	Superior

Table 5. Test for assessing effect of hair lotion on hair

	Smoothness	Luster	Wet feel
<u>Example</u>			
14	4.8	4.4	4.0
15	4.6	4.4	4.0
16	4.4	4.2	4.2
17	4.0	3.8	3.6
18	4.8	4.4	4.4
19	3.8	3.0	4.0
<u>Comp.</u>			
<u>Example</u>			
5	3.4	3.2	3.4
6	3.0	2.8	3.2
7	2.4	2.6	3.0
8	3.2	1.8	2.0

As shown in Table 5, it was made clear that the CHP 0.9-containing hair lotion is superior in any of the smoothness, luster and wet feel.

EXAMPLE 15

Preparation of CHP 0.1-containing hair lotion and assessment test

With the same blending proportion and by the same preparation procedures as in Example 14 except that the CHP 0.1 obtained in Synthesis Example 3 was used instead of the CHP 0.9, a hair lotion was prepared. All the assessment tests were also carried out in the same manner as in Example 14. Results are recited in Table 5.

#### EXAMPLE 16

##### Preparation of CHP 0.05-containing hair lotion and assessment test

With the same blending proportion and by the same preparation procedures as in Example 14, except that the CHP 0.05 obtained in Synthesis Example 4 was used instead of the CHP 0.9, a hair lotion was prepared. All the assessment tests were also carried out in the same manner as in Example 14. Results are recited in Table 5.

#### EXAMPLE 17

##### Preparation of CHP 10-containing hair lotion and assessment test

With the same blending proportion and by the same preparation procedures as in Example 14, except that the CHP 10 obtained in Synthesis Example 5 was used instead of the CHP 0.9, a hair lotion was prepared. All the assessment tests were also carried out in the same manner as in Example 14. Results are recited in Table 5.

#### EXAMPLE 18

##### Preparation of CHP 15-containing hair lotion and assessment test

With the same blending proportion and by the same preparation procedures as in Example 14, except that the CHP 15 obtained in Synthesis Example 6 was used instead of the CHP 0.9, a hair lotion was prepared. All the assessment tests were also carried out in the same manner as in Example 14. Results are recited in Table 5.

#### EXAMPLE 19

##### Preparation of CHM-containing O/W type milky lotion and assessment test

With the same blending proportion and by the same preparation procedures as in Example 14, except that the CHM obtained in Synthesis Example 7 was used instead of the CHP 0.9, a hair lotion was prepared. All the assessment tests were also carried out in the same manner as in Example 14. Results are recited in Table 5.

#### COMPARATIVE EXAMPLE 5

##### Preparation of TSP 5-containing hair lotion and assessment test

With the same blending proportion and by the same preparation procedures as in Example 14, except that the TSP obtained in Synthesis Example 8 was used instead of the CHP 0.9, a hair lotion was prepared. All the assessment tests were also carried out in the same manner as in Example 14. Results are recited in Table 5.

#### COMPARATIVE EXAMPLE 6

##### Preparation of pullulan-containing hair lotion and assessment test

With the same blending proportion and by the same preparation procedures as in Example 14, except that a commercial pullulan (weight-average molecular weight of 108,000) was used instead of the CHP 0.9, a hair lotion was prepared. All the assessment tests were also carried out in the same manner as in Example 14. Results are recited in Table 5.

#### COMPARATIVE EXAMPLE 7

##### Preparation of CHP-not-containing hair lotion and assessment test

With the same blending proportion and by the same preparation procedures as in Example 14, except that the CHP 0.9 was not incorporated, a hair lotion was prepared. All the assessment tests were also carried out in the same manner as in Example 14. Results are recited in Table 5.

#### COMPARATIVE EXAMPLE 8

##### Preparation of polyvinyl alcohol-containing hair lotion and assessment test

With the same blending proportion and by the same preparation procedures as in Example 14, except that a commercial polyvinyl alcohol (a product of Kuraray Co., Ltd. with trademark of KURARE POVAL PVA-224C) was used instead of the CHP 0.9, a hair lotion was prepared. All the assessment tests were also carried out in the same manner as in Example 14. Results are recited in Table 5.

#### EXAMPLE 20

##### Preparation of CHP 0.9-containing liquid lip rouge and assessment test

69 parts by weight of a polydimethylsiloxane (a product of Shin-Etsu Chemical Co., Ltd. with trademark KF 96, having a standard viscosity of 100,000 mm<sup>2</sup>/sec) and 15 parts by weight of the CHP 0.9 obtained in Synthesis Example 2 were mixed together with agitation at a temperature of 70 - 80 °C to cause dissolution. On the other hand, 5.0 parts by weight of glyceryl

triisostearate and 10.0 parts by weight of Red 226 were processed on a roller. This roller-treated mass was admixed to the polydimethylsiloxane solution of CHP 0.9 to disperse it therein. By admixing an adequate amount of perfume to this dispersion after this dispersion had been degassed, 100 grams of a CHP 0.9-containing liquid lip rouge were obtained. In order to assess the properties of this CHP 0.9-containing liquid lip rouge, the following assessment test was carried out.

[Transcription Test]

Two filter papers were provided for, of which one was impregnated with water and the other one was impregnated with squalene. A colorless nylon plate coated with an adequate amount of the CHP 0.9-containing liquid lip rouge and dried was pressed onto the filter paper impregnated with squalene with ten repeats of up-and-down motions. Also for the filter paper impregnated with water similar operations were performed with repeats of up-and-down motion. After the repetitions of up-and-down motion, the color deepness of the filter paper due to color transference from the nylon plate was visually assessed by one and the same observer (a professional assessor in this firm). The assessment was realized in a judgement criterion, in which the case where no transcription was recognized scores one point, the case where a scarce transcription was recognized scores two points and the case where transcription was remarkable scores three points. The assessment test was carried out in five repeats using in each case newly prepared filter papers

with impregnation with water and with squalene. The visual assessment of the transcribed color by five repetitions was performed by one and the same person. Each assessment score is given by an average of five assessments on the filter papers impregnated with water and with squalene. The results are recited in Table 6.

Table 6. Transcription test for liquid lip rouge

		Average score
Example	20	2.2
	21	2.0
	22	2.4
	23	1.8
	24	1.8
	25	2.4
Comp. Example	9	2.6
	10	3.0
	11	3.0
	12	2.8

#### EXAMPLE 21

##### Preparation of CHP 0.1-containing liquid lip rouge and assessment test

With the same blending proportion and by the same preparation procedures as in Example 20 except that the CHP 0.1 obtained in Synthesis Example 3 was used instead of the CHP 0.9, a liquid lip rouge was prepared. All the assessment tests were also carried



out in the same manner as in Example 20. Results are recited in Table 6.

EXAMPLE 22

Preparation of CHP 0.05-containing liquid lip  
rouge and assessment test

With the same blending proportion and by the same preparation procedures as in Example 20, except that the CHP 0.05 obtained in Synthesis Example 4 was used instead of the CHP 0.9, a liquid lip rouge was prepared. All the assessment tests were also carried out in the same manner as in Example 20. Results are recited in Table 6.

EXAMPLE 23

Preparation of CHP 10-containing liquid lip  
rouge and assessment test

With the same blending proportion and by the same preparation procedures as in Example 20, except that the CHP 10 obtained in Synthesis Example 5 was used instead of the CHP 0.9, a liquid lip rouge was prepared. All the assessment tests were also carried out in the same manner as in Example 20. Results are recited in Table 6.

EXAMPLE 24

Preparation of CHP 15-containing liquid lip  
rouge and assessment test

With the same blending proportion and by the same preparation procedures as in Example 20, except that the CHP 15 obtained in Synthesis Example 6 was used instead of the CHP 0.9, a liquid lip rouge was prepared. All the assessment tests were also carried

out in the same manner as in Example 20. Results are recited in Table 6.

#### EXAMPLE 25

##### Preparation of CHM-containing liquid lip rouge and assessment test

With the same blending proportion and by the same preparation procedures as in Example 20, except that the CHM obtained in Synthesis Example 7 was used instead of the CHP 0.9, a liquid lip rouge was prepared. All the assessment tests were also carried out in the same manner as in Example 20. Results are recited in Table 6.

#### COMPARATIVE EXAMPLE 9

##### Preparation of TSP 5-containing liquid lip rouge and assessment test

With the same blending proportion and by the same preparation procedures as in Example 20, except that the TSP obtained in Synthesis Example 8 was used instead of the CHP 0.9, a liquid lip rouge was prepared. All the assessment tests were also carried out in the same manner as in Example 20. Results are recited in Table 6.

#### COMPARATIVE EXAMPLE 10

##### Preparation of pullulan-containing liquid lip rouge and assessment test

With the same blending proportion and by the same preparation procedures as in Example 20, except that a commercial pullulan (weight-average molecular weight of 108,000) was used instead of the CHP 0.9, a liquid lip rouge was prepared. All the assessment tests

were also carried out in the same manner as in Example 20. Results are recited in Table 6.

COMPARATIVE EXAMPLE 11

Preparation of CHP-not-containing liquid lip  
rouge and assessment test

With the same blending proportion and by the same preparation procedures as in Example 20, except that the CHP 0.9 was not incorporated, a liquid lip rouge was prepared. All the assessment tests were also carried out in the same manner as in Example 20. Results are recited in Table 6.

COMPARATIVE EXAMPLE 12

Preparation of polyvinyl alcohol-containing  
liquid lip rouge and assessment test

With the same blending proportion and by the same preparation procedures as in Example 20, except that a commercial polyvinyl alcohol (a product of Kuraray Co., Ltd. with trademark of KURARE POVAL PVA-224C) was used instead of the CHP 0.9, a liquid lip rouge was prepared. All the assessment tests were also carried out in the same manner as in Example 20. Results are recited in Table 6.

EXAMPLE 26

Preparation of CHP 0.9-containing colored  
manicure and assessment test

10.82 parts by weight of nitrocellulose, 9.74 parts by weight of a toluenesulfonamide formaldehyde resin (a product of the firm Akuzo with trade mark KETJENFLEX MS 80), 6.495 parts by weight of tributyl acetylcitrate (a product of Pfizer K.K. with trademark

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CITROFLEX A4), 30.91 parts by weight of toluene, 21.64 parts by weight of butyl acetate, 9.27 parts by weight of ethyl acetate, 7.72 parts by weight of isopropyl alcohol, 1.35 parts by weight of stearalkonium hectorite, 1.00 part by weight of the CHP 0.9 obtained in Synthesis Example 2 and 0.055 part by weight of citric acid were mixed to cause dissolution, whereby a total of 100 grams of a colored manicure liquid was obtained. In order to evaluate the properties of this colored manicure liquid, assessments given below were carried out.

《Assessment of adhesiveness》

The CHP 0.9-containing colored manicure liquid was tested by practical use by seven ordinary women of average age of 23.2 for one week. After such practical use, each volunteer was asked by a professional investigator individually for her judgement as to the adhesiveness. The case where the volunteer gave an answer that the adhesiveness was better scores three points. The case where the volunteer gave an answer that the adhesiveness was not worse nor better scores two points. The case where the volunteer gave an answer that the adhesiveness was worse scores one point. All the answers were summarized. The results are recited in Table 7.

《Assessment of luster》

The CHP 0.9-containing colored manicure liquid was tested by practical use by seven ordinary women of average age of 23.2 for one week. After such practical use, each volunteer was asked by a professional

investigator individually for her judgement as to the luster. The case where the volunteer gave an answer that the luster was better scores three points. The case where the volunteer gave an answer that the luster was not worse nor better scores two points. The case where the volunteer gave an answer that the luster was worse scores one point. All the answers were summarized. The results are recited in Table 7.

Table 7. Test of assessment of colored manicure liquid

	Adhesiveness (total score summed)	Luster (total score summed)
<u>Example</u>		
26	17	16
27	15	18
28	13	15
29	19	16
30	18	14
31	14	15
<u>Comp.</u>		
<u>Example</u>		
13	11	14
14	12	7
15	9	8
16	11	10

EXAMPLE 27

Preparation of CHP 0.1-containing colored  
manicure liquid and assessment test

With the same blending proportion and by the same preparation procedures as in Example 26 except

that the CHP 0.1 obtained in Synthesis Example 3 was used instead of the CHP 0.9, a colored manicure liquid was prepared. All the assessment tests were also carried out in the same manner as in Example 26. Results are recited in Table 7.

#### EXAMPLE 28

##### Preparation of CHP 0.05-containing colored manicure liquid and assessment test

With the same blending proportion and by the same preparation procedures as in Example 26, except that the CHP 0.05 obtained in Synthesis Example 4 was used instead of the CHP 0.9, a colored manicure liquid was prepared. All the assessment tests were also carried out in the same manner as in Example 26. Results are recited in Table 7.

#### EXAMPLE 29

##### Preparation of CHP 10-containing colored manicure liquid and assessment test

With the same blending proportion and by the same preparation procedures as in Example 26, except that the CHP 10 obtained in Synthesis Example 5 was used instead of the CHP 0.9, a colored manicure liquid was prepared. All the assessment tests were also carried out in the same manner as in Example 26. Results are recited in Table 7.

#### EXAMPLE 30

##### Preparation of CHP 15-containing colored manicure liquid and assessment test

With the same blending proportion and by the same preparation procedures as in Example 26, except

that the CHP 15 obtained in Synthesis Example 6 was used instead of the CHP 0.9, a colored manicure liquid was prepared. All the assessment tests were also carried out in the same manner as in Example 26. Results are recited in Table 7.

#### EXAMPLE 31

##### Preparation of CHM-containing colored manicure liquid and assessment test

With the same blending proportion and by the same preparation procedures as in Example 26, except that the CHM obtained in Synthesis Example 7 was used instead of the CHP 0.9, a colored manicure liquid was prepared. All the assessment tests were also carried out in the same manner as in Example 26. Results are recited in Table 7.

#### COMPARATIVE EXAMPLE 13

##### Preparation of TSP 5-containing colored manicure liquid and assessment test

With the same blending proportion and by the same preparation procedures as in Example 26, except that the TSP obtained in Synthesis Example 8 was used instead of the CHP 0.9, a colored manicure liquid was prepared. All the assessment tests were also carried out in the same manner as in Example 26. Results are recited in Table 7.

#### COMPARATIVE EXAMPLE 14

##### Preparation of pullulan-containing colored manicure liquid and assessment test

With the same blending proportion and by the same preparation procedures as in Example 26, except

that a commercial pullulan (weight-average molecular weight of 108,000) was used instead of the CHP 0.9, a colored manicure liquid was prepared. All the assessment tests were also carried out in the same manner as in Example 26. Results are recited in Table 7.

#### COMPARATIVE EXAMPLE 15

##### Preparation of CHP-not-containing colored manicure liquid and assessment test

With the same blending proportion and by the same preparation procedures as in Example 26, except that the CHP 0.9 was not incorporated, a colored manicure liquid was prepared. All the assessment tests were also carried out in the same manner as in Example 26. Results are recited in Table 7.

#### COMPARATIVE EXAMPLE 16

##### Preparation of polyvinyl alcohol-containing manicure liquid and assessment test

With the same blending proportion and by the same preparation procedures as in Example 26, except that a commercial polyvinyl alcohol (a product of Kuraray Co., Ltd. with trademark of KURARE POVAL PVA-224C) was used instead of the CHP 0.9, a colored manicure liquid was prepared. All the assessment tests were also carried out in the same manner as in Example 26. Results are recited in Table 7.

As described above, it is possible according to the present invention to provide novel cosmetic products which are superior markedly in the beauty skin effect



and in the beauty hair effect due to moisture-retentive function, rough skin preventing effect, coating film-forming ability and so on and which does not suffer from any safety problem with an adaptively maintained moisture preserving ability and coating film-formation ability.

#### INDUSTRIAL APPLICABILITY

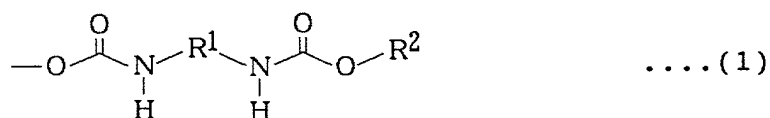
The cosmetic products according to the present invention can be used adaptively as, for example, cosmetic product for skin care, cosmetic product for hair conditioning and cosmetic product for make-up.

# CLAIMS

1. A cosmetic product containing polysaccharide-sterol derivative, comprising cosmetic components and a polysaccharide-sterol derivative.

2. The cosmetic product as claimed in claim 1, wherein the polysaccharide-sterol derivative is one in which steryl groups are introduced in a proportion of 0.01 to 20 groups per 100 monosaccharide units constituting the polysaccharide.

3. The cosmetic product as claimed in claim 1 or 2, wherein the hydroxyl groups of the monosaccharide units constituting the polysaccharide of the polysaccharide-sterol derivative are substituted, in a proportion of 0.01 to 20 groups per 100 monosaccharide units, by the radical represented by the formula (1)



in which R<sup>1</sup> denotes a hydrocarbyl of 1 - 10 carbon atoms and R<sup>2</sup> represents a steryl group.

4. The cosmetic product as claimed in claim 2 or 3, wherein the proportion of introduction of the steryl groups is 0.05 - 15 groups per 100 monosaccharide units constituting the polysaccharide.

5. The cosmetic product as claimed in claim 2 or 3, wherein the proportion of introduction of the steryl groups is 0.1 - 10 groups per 100 monosaccharide units constituting the polysaccharide.

6. The cosmetic product as claimed in any one of claims 1 to 5, wherein the polysaccharide-sterol

derivative is a pullulan-cholesterol derivative.

7. The cosmetic product as claimed in any one of claims 1 to 6, wherein the content of the polysaccharide-sterol derivative is in the range from 0.001 to 50 %, based on the total weight of the cosmetic product.

8. The cosmetic product as claimed in any one of claims 1 to 7, wherein the cosmetic product is a skin care cosmetic, make-up cosmetic or hair conditioning cosmetic.

9. The cosmetic product as claimed in any one of claims 1 to 7, wherein the cosmetic product is an emulsion, a beauty wash, a rouge, a manicure or a hair lotion.

# DECLARATION FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled COSMETIC PRODUCT CONTAINING POLYSACCHARIDE-STEROL DERIVATIVE

\_\_\_\_\_, the specification of which (check \_\_\_\_\_ is attached hereto.

one) X was filed on March 30, 2000, as Application Serial No. PCT/JP 00/02044 and was amended on \_\_\_\_\_ (if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)			Priority Claimed	
<u>92401/1999</u> (Number)	<u>Japan</u> (Country)	<u>31/03/1999</u> (Day/Month/Year Filed)	<u>X</u> Yes	<u>      </u> No
<u>          </u> (Number)	<u>          </u> (Country)	<u>          </u> (Day/Month/Year Filed)	<u>      </u> Yes	<u>      </u> No
<u>          </u> (Number)	<u>          </u> (Country)	<u>          </u> (Day/Month/Year Filed)	<u>      </u> Yes	<u>      </u> No

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

<u>          </u> (Application Serial No.)	<u>          </u> (Filing Date)	<u>          </u> (Status) (patented, pending, abandoned)
<u>          </u> (Application Serial No.)	<u>          </u> (Filing Date)	<u>          </u> (Status) (patented, pending, abandoned)

0936953 091701

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

Dale H. Thiel (Reg. No. 24 323), David G. Boutell (Reg. No. 25 072), Ronald J. Tanis (Reg. No. 22 724), Terryence F. Chapman (Reg. No. 32 549) and Mark L. Maki (Reg. No. 36 589). 4

Send correspondence to:  
FLYNN, THIEL, BOUTELL & TANIS, P.C.  
2026 Rambling Road  
Kalamazoo, Michigan 49008-1699

Direct telephone calls to:  
(616) 381-1156

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or first inventor Junzo SUNAMOTO  
Inventor's signature Junzo Sunamoto August 28th, 2001  
Residence Kusatsu-Shi, Shiga, Japan JPX Date  
Citizenship Japan  
Post Office Address 1-30-1013, Shibukawa 1-Chome, Kusatsu-Shi,  
Shiga 525-0026, Japan

Full name of second joint inventor, if any Kunio SHIMADA  
Inventor's signature Kunio Shimada Aug. 25, 2001  
Residence Toride-Shi, Ibaraki, Japan JPX Date  
Citizenship Japan  
Post Office Address 12-6, Inodai 4-Chome, Toride-Shi, Ibaraki 302-0012, Japan

Full name of third joint inventor, if any Akio HAYASHI  
Inventor's signature Akio Hayashi Aug. 29, 2001  
Residence Adachi-Ku, Tokyo, Japan JPX Date  
Citizenship Japan  
Post Office Address 12-12, Kahei 3-Chome, Adachi-Ku, Tokyo 121-0055, Japan

(Supply similar information and signature for fourth and subsequent joint inventors.)

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

Dale H. Thiel (Reg. No. 24 323), David G. Boutell (Reg. No. 25 072), Ronald J. Tanis (Reg. No. 22 724), Terryence F. Chapman (Reg. No. 32 549) and Mark L. Maki (Reg. No. 36 589).

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FLYNN, THIEL, BOUTELL & TANIS, P.C.  
2026 Rambling Road  
Kalamazoo, Michigan 49008-1699

Direct telephone calls to:  
(616) 381-1156

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or fourth inventor <sup>4-00</sup> Ryuzo HOSOTANI

Inventor's signature Ryuzo Hosotani Aug. 31, 2001  
Date

Residence Nishinomiya-Shi, Hyogo, Japan JPX

Citizenship Japan

Post Office Address 1-13, Higashinaruo-Cho 1-Chome, Nishinomiya-Shi,  
Hyogo 663-8132, Japan

Full name of fifth joint inventor, if any <sup>5-00</sup> Yoshihiro YANO

Inventor's signature Yoshihiro Yano August 23, 2001  
Date

Residence Tsukuba-Shi, Ibaraki, Japan JPX

Citizenship Japan

Post Office Address 15-5, Umezono 2-Chome, Tsukuba-Shi, Ibaraki 305-0045, Japan

Full name of sixth joint inventor, if any <sup>6-00</sup> Kazunari AKIYOSHI

Inventor's signature Kazunari Akiyoshi August 30, 2001  
Date

Residence Uji-Shi, Kyoto, Japan JPX

Citizenship Japan

Post Office Address 25-2, Ogura-Cho Horiiike, Uji-Shi, Kyoto 611-0042, Japan

(Supply similar information and signature for fourth and subsequent joint inventors.)

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